

The Edible Pacaya Palm of Alta Vera Paz

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THE native name pacaya is widely current in Central America for the small reed-like palms usually known to botanists as species of *Chamaedorea*, a numerous, diversified group with the sexes on separate plants and the floral structures much specialized. Several genera were defined in the last century by Liebmamn, Klotzsch, Wendland, and Oersted, but usually are disregarded, perhaps on account of forbidding names: *Eleutheropetalum*, *Stachyphorbe*, *Psilotachys*, *Dasytachys*, *Stenostachys*, and *Spathoscaphe*.

An outstanding member of this group has local prominence as a food plant in the Department of Alta Vera Paz, in eastern Guatemala, the young male inflorescence being the part used. This palm is very distinct in its floral structure from the original species of *Chamaedorea*, native in Venezuela, and apparently is not properly assignable to any of the genera mentioned above. The edible inflorescence suggests the generic name *Edanthe* for the new palm, which may have a future as a tree-crop as well as an ornamental in tropical and semitropical countries, including Florida and California.

The edible quality arises from a structural feature, the inflorescence being enclosed and protected to the time of flowering by two very large complete spathes, so that the texture remains fleshy. Other specialized characters are the flower-buds forming a complete pavement over the surface of the branches, the applanate corolla, columnar filaments, apical anthers, and rudimentary calyx of the male flowers. The inflorescences of most of the related palms have only short spathes, with the flowering axis and branches

emerging at an early stage, and the buds standing separately along the branches.

Pacaya as a palm name apparently is restricted to Central America, although the same word is used in Peru and in Mexico for several large leguminous trees, species of *Inga* or related genera, also known as *guabo* and *cua-jiniquil*, the possible connection being that the large pods of these trees contain a soft edible tissue surrounding the seeds, technically a fleshy arillus, with a remote resemblance to the food material of the palms. Such an origin might explain why in popular use the name pacaya often is applied, not to the entire palm, but to the male inflorescence.

Smaller species furnish edible pacayas in other districts, and any small ornamental palms, or even palm-leaves gathered in the forests for ornamental use, may be called pacayas. Many members of the *Chamaedorea* group have extremely graceful foliage, of a vivid emerald green color, and often are used for decorating churches and public buildings on feast days or other celebrations, or for planting as ornamentals in yards and gardens. The stems are green as well as the leaves, and some of the species grow in clumps like bamboos.

The word pacaya does not appear in the *Diccionario de la Lengua Maya* by Perez, 1866-1877, nor in the list of Maya plant names in the *Idioma Maya*, 1898, but is included in Brasseur de Bourbourg's Grammar of the Quiché Language, 1862. Alemany's *Diccionario de la Lengua Espanola*, 1917, has the word pacaya defined for Costa Rica and Honduras as a "gigantic fern whose shoot is edible," and also the

word *pacayar*, "plantio de pacayes," as though plantings were made. The Kekchi people, in the district of Caja-bon say "pacay," in two syllables, and this is considered a native word.

AN INCIPIENT DOMESTICATION

The large pacaya palm of Alta Vera Paz may be said to have reached the status of a cultivated plant, at least in the vicinity of Coban, the capital and trading center of that district, chiefly known for producing coffee of high quality. The forests still furnish many of the pacayas that are brought to the local markets, but large quantities are produced in gardens and dooryards, and in neighboring coffee plantations. The coffee trees live many years and grow to very large size, the dense foliage effectually shading and protecting the soil with a surface mulch of dead leaves, so that special shade trees are not required, but the pacaya palms thrive among the coffee as well or better than in the forests. A coffee plantation in Coban, bordered with pacaya palms, is shown in figure 1. A closer view of younger palms in the patio of the German Club at Coban is given in figure 2.

Most of the other pacaya palms are of small size, living as undergrowth in the lowland tropical forests, but more numerous and varied in the higher altitudes, some of the mountain species attaining larger proportions, though only a few with trunks 2 inches in diameter. Alta Vera Paz is a very mountainous district with the pacaya group richly represented, including what may prove to be its largest member. The trunks of Edanthe grow in favorable places more than 20 feet tall, and more than 3 inches in diameter, sometimes nearly 4 inches, the leaf-blades over 6 feet long and 4 feet wide, with 30 pinnae or more on each side, and the edible male inflorescences the

size of large ears of maize, cased in green husk-like spathes more than 2 feet long. Even yard-long inflorescences are reported in the district of San Cristobal, but may be exaggerated. The basal and terminal sections of a rather small specimen are shown in natural size in figures 3 and 4.

The many pacaya palms planted or allowed to grow in gardens, dooryards and coffee groves of Coban and of many other localities in Alta Vera Paz, are a very attractive feature. This section of Guatemala is not volcanic, but a varied and beautiful limestone country, of springs, cascades, caverns, and startling sinks or "siguanas," where streams fall suddenly into underground courses. The plant life of Alta Vera Paz is extremely varied, most of it accessible as yet only by bridle-trails or foot-paths.

DIFFERENCES BETWEEN THE SEXES

The two sexes of the Verapaz pacaya differ greatly, not only in the structure of the flowers, but also in the sequence or mode of development. As already indicated, the male inflorescences are provided with much larger spathes, giving complete protection for the buds nearly to the stage of flowering, as shown in figure 5, while with the female inflorescences only the early stages are covered, the small female spathes being greatly exceeded by the later growth of the axis and branches, seen in figure 8.

A perceptible thickening of the male branches, and enlargement of the flowers, takes place with the opening of the spathes, from the bud stage, in figure 3, to the flower stage, in figure 6, but this change is very slight in comparison with the continued growth of the female inflorescence, before and after the flowering stage.

The male inflorescence is relatively



Figure 2. *Pacaya palms in patio at Coban, Guatemala.*

temporary, its function having ceased before the fruits begin to grow. Cutting off the male inflorescences before the full development is attained apparently does not weaken the palms, but may leave them in better condition for the next crop, while the female palms require the entire season for production of seeds. Thus a cultural advantage may be seen in a food product supplied by the male sex.

Only a few species of plants with separate sexes have been domesticated for use as food. The date palm and the tropical papaya are the best-known examples, and in these cases the useful product is the fruit, furnished by the female plant. An edible product furnished by the male plant apparently is without precedent. Pollen of *Typha* is collected for food in India, but the plant is not dioecious.

The Kekchi Indians of the district of Cajabon recognize the two sexes of the palm under different names, but adhere to their custom of considering the productive plants as the female, so that in this case the native terminology reverses the sexes. The male palm with the edible inflorescences is called by the Indians "ixqui-quib," meaning "woman palm," while the female plant, because its inflorescence is not eaten, is called "telom-quib," or "man palm," notwithstanding that it produces the seed.

Although the female inflorescences are not used, many female palms are allowed to grow, so that an abundance of seed is produced, and the seedlings develop with little or no care, under the protection of the coffee trees. The fruits are borne in large clusters, green at first, eventually turning a dull purple like small olives, with a thin greenish pulp and a hard seed. Similar fruits of royal palms are eaten by wild birds, also by cattle, pigs, and poultry.

USE OF THE MALE INFLORESCENCE

The edible inflorescences are gathered when they have reached their full growth, but before the enclosing spathes have begun to split. At this stage of development the flower-bearing part of the inflorescence is eaten as a vegetable or a salad. The texture is tender and succulent, not at all fibrous or stringy. Like other vegetables or "greens," the palm inflorescences require only to be boiled and seasoned, or they can be treated by any special culinary methods that are used with vegetables or salads. The taste is slightly bitter, but the flavor is generally relished. According to Standley, "dipped in beaten eggs and fried—they form a delicious dish."

The use of the pacaya is not limited to the native population, many resident Europeans considering it a special delicacy. It is a general custom to eat these palm inflorescences during Holy week, between Palm Sunday and Easter, and at that time great quantities are brought in from the forests of the Coban district to the markets of the neighboring towns. Pacayas piled for sale in the native market at San Cristobal are shown in figure 4, also the two sexes with the spathes removed in figure 3, the larger inflorescence the male, at the edible stage.

The texture and taste render the pacaya comparable to asparagus or cauliflower, or to the terminal buds of many palms long appreciated as delicacies in tropical countries, and known as "palm cabbage." Since the cutting of a cabbage occasions the destruction of the entire palm, a rapid extermination may result. One of the most beautiful palms in Central America, a member of the royal palm family, has been eradicated from many localities in Alta Vera Paz, for the sake of its cabbage. This is the so-called *ternera* or *halaute*, *Plectis oweniana*, a tall and striking



Figure 3. *Pacaya* male inflorescences at edible stage, female at left,
natural size.

palm, still abundant in remote localities and on the least accessible summits of the mountains, but never allowed to grow to maturity in places where it can be seen from a trail. A leaf of the *tenera* that emerges above the forest, after many years of hidden juvenile growth, serves at once as a signal for an observant native to seek out the palm and cut it down, usually before the fruiting stage is reached, so that eventual extinction must be expected. The pacaya may be considered as a cabbage palm that bears every year.

INTRODUCTION TO THE UNITED STATES

Since slight frosts and periods of cold weather occur in the elevated districts of Coban and San Cristobal, which are centers of the pacaya industry of Alta Vera Paz, an introduction of the pacaya palm into the warmer districts of Florida and California was attempted. In the spring of 1914 a quantity of seed was obtained by the Department of Agriculture and planted at the Government propagating garden near Garrett Park, Md. Most of the seeds germinated, and several hundred vigorous seedlings were distributed in the next year for experimental planting, numbers 38403-4.

Some of the plants were kept in conservatories, while others were set in open places, too much exposed to sun and wind, so that the foliage was burned or frayed. "Fine under lath, stood 33 degrees," was reported from St. Petersburg, Fla. At San Diego, Calif., and at Santa Barbara several palms in sheltered places or in slat-houses made normal growth, and in April 1923 were producing inflorescences. A few were kept in greenhouses at Washington and planted in recent years in sheltered rock-pits at Coconut Grove, Fla., where they have flowered and fruited. The only living specimen of Edanthe remaining in Wash-

ton is in the patio of the Pan American Union, at the northeast corner, a rather slender male palm, but flowering every year.

From this experience there is nothing to indicate that pacaya palms could not be grown and fruited in favorable places, either in California or southern Florida, if sufficient interest were felt to keep them under suitable conditions, not too shady for vigorous growth, but well protected from the wind, especially in dry or cold weather.

A SPECIES NAMED PACAYA IN COSTA RICA

The name *Chamaedorea pacaya* unfortunately was given by Oersted in 1858 to a small Costa Rican palm, not an edible species and very different from Edanthe. It is a slender forest palm with leaves only 2 to 3 feet long, the leafsheathes and petioles only 5 inches long, and only 7 pairs of pinnae, the middle pinnae 7 to 8 inches long, and 1½ inches wide, the terminal pair very broad, with the outer margin serrate. The female inflorescence is 19 inches long, the peduncle 14 inches, with 5 to 6 spathes, the axis very short, 1½ inches, and only 5 or 6 branches 3 to 4 inches long.

The male inflorescence was not described by Oersted, but is represented among the specimens in the National Herbarium, some of them with young inflorescences emerging from sheaths of living leaves, the second joint of the peduncle much longer than the basal joint, the axis short and the branches few, as in the female. The male flowers are rather close together and the petals strongly striate, opening at the sides, showing that the palm has no botanical relationship with the edible pacayas.

A continued use of this specific name, so definitely implying that the palm is a true edible pacaya, must always be misleading. The rule of re-

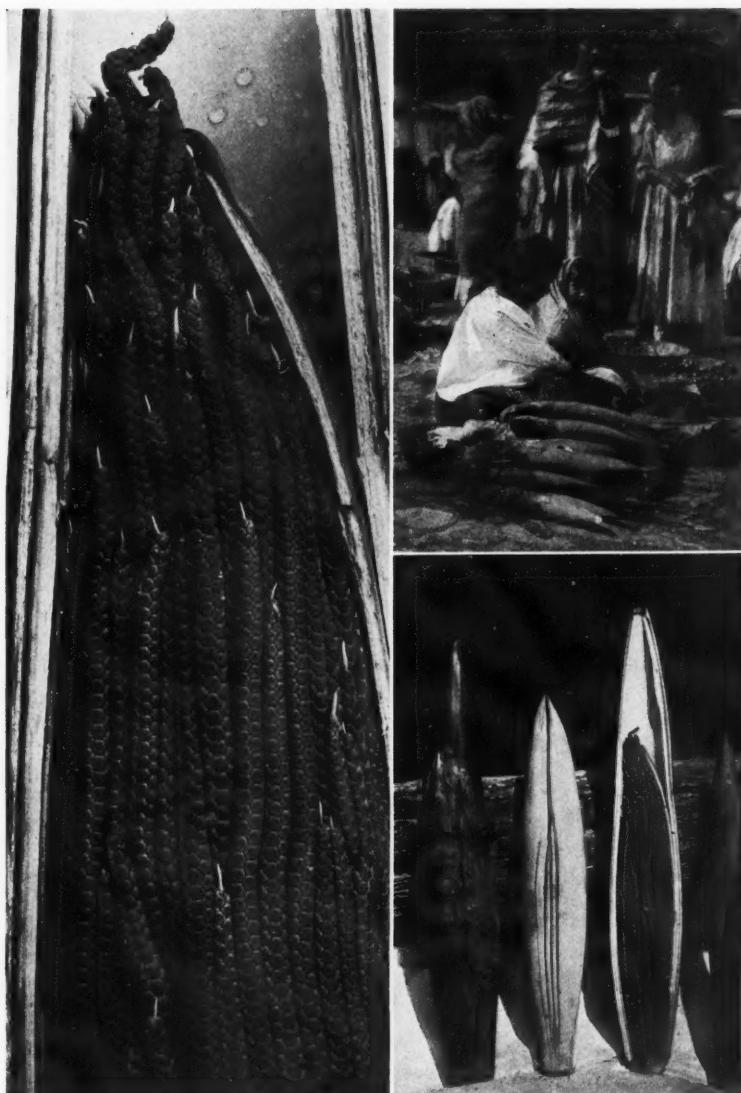


Figure 4. Edible pacayas with enclosing spathes. Sold in native markets.

placing names that cause confusion may be observed in this case by giving to Oersted's *Chamaedorea pacaya* the name *Chamaedorea oerstedi*. The cespitose "pacaya" much planted as an ornamental at San Jose, is a different species, described by Oersted as *Chamaedorca costaricana*.

STATURE AND HABITS OF GROWTH

Most of the related palms that approach Edanthe in size are of cespitose habit, with off-shoots sprouting from the lower trunk-sections or from creeping rootstocks, forming clumps like bamboos and capable of vegetative propagation by rooting the small shoots or dividing the clusters. Edanthe not only is a solitary palm but differs from many of the cespitose forms in having the sections of the trunk rather short and thick, sometimes twice as long as broad, but not several times as long, as the tendency among the reed-like cespitose palms. In the lower part of the trunk the sections usually are somewhat longer than broad, but in the upper part much shorter, only a third or a quarter of the width, so that the upward growth of the adult palms is much slower. Once established in a favorable place, the palms probably live for twenty or thirty years. A short juvenile period is indicated, since fruiting begins near the ground, as shown in figure 8.

TEXTURE OF THE SPATHES

The spathes that protect the male inflorescence not only are the largest of any known in the Chamaedorea group, but afford a thicker covering, two of the spathes being complete and the third long enough to enwrap all but the tip of the bundle of branches. Also the texture of the spathes is somewhat different, fleshy and less fibrous than in most of the related palms, rather stiff and firm and brittle in the

fresh state, but tending in moist weather to early decay and deliquescence. The smaller basal spathes are notably marcescent, as though partly decayed before the inner spathes open, as in figure 5, and all of the spathes on the female inflorescences may disappear before the fruit ripens, as in figure 9, leaving the peduncle clean and displaying its red color.

AXIS AND BRANCHES

Both sexes have numerous branches, but the female axis, though bearing fewer branches than the male, is much longer, and the branches more widely separated. The very compact tassel of the male inflorescence is shown in figures 5 and 6, the open tassel of the female inflorescence in figure 8. The male inflorescences are sheathed to the time of flowering in large "complete" spathes, while the female inflorescences grow out beyond the spathes at a much earlier stage of development, represented in figure 3, at the left, the axis eventually becoming very long and the branches widely separated, as in figure 8.

The female axis and branches, though white at first, gradually become green, sprinkled with whitish points marking the position of stomata, shown enlarged in figure 7. Before emergence from the spathes the female inflorescence is white, but the buds somewhat greenish, the color difference apparent in figure 3.

The male branches are abruptly narrowed near the end, the slender white tips, shown in natural size in figure 4, closely beset with minute abortive flowers. A fasciated lower branch of a male inflorescence is shown in figure 3, all of the branches usually being simple.

TESSELALE MALE FLOWERS

Four general types of flower arrangement may be distinguished among the

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Figure 5. Mature male inflorescence, with open spathes

palms of the Chamaedorea group. In the first or more primitive arrangement the flowers may be described as *remote*, that is, standing well apart along the branches, as in the genus *Neanthe*, described and illustrated in THE NATIONAL HORTICULTURAL MAGAZINE for January 1938. The second type has inflorescences with *separate* flowers, rather close together but not touching, as illustrated by Oersted in the male flowers of *Eleutheropetalum*. The third type may be termed *approximate*, with the flowers contiguous or even crowded, but not structurally modified for standing together, the buds rounded, and the corolla surrounded at the base by a broadly three-lobed projecting calyx, as in Oersted's drawings of *Stephanostachys wendlandiana* and *Spathoscaphe arenbergiana*.

The fourth type of arrangement, represented by *Edanthe*, is the most specialized, the flowers flattened and tessellate, that is, set closely and regularly together, forming a complete pavement over the surface of the branches, as shown in figures 3, 6, and 7. The corolla usually is 6-sided, more or less angled by mutual pressure of the adjacent flowers, and the calyx is obsolete, reduced to a narrow rim completely concealed under the corolla. The outer surface of the flowers is moderately convex, with the broadly angled apices of the petals first separating as a narrow triangular slit, then rolling back and exposing the broad short anther-cells. The petals are bent abruptly inward from the sides, the longitudinal section appearing geniculate.

A further modification is that the flowers are broadened as well as flattened, affording room for the stamens to stand rather wide apart. Shrinkage in drying has the effect of making the flowers of *Edanthe* appear much longer than broad, as represented in Oersted's

drawings of the male flowers of *Stephanostachys wendlandiana* (L' Amerique Centrale, plate 7). But in the fresh flowers, shown in our figures 6 and 7 it is seen that the cross diameter is not less than the longitudinal diameter, often slightly greater.

The tessellate arrangement of the male flower-buds of *Edanthe* and the separate spacing of the female flower-buds are shown in figures 3 to 9; the stage of open male flowers in figure 6, the flowers of both sexes magnified in figure 7, the flowering stage of the female inflorescences in plate 8, and the mature fruits in figure 9. It is plain from the size of the fruits that the female flowers are not spaced more widely than necessary.

Another genus with tessellate male flowers, *Dasytachys*, was described and illustrated by Oersted, a small simple-leaved palm with the inflorescences of both sexes simple, and the flowers congested. The calyx is a deep cup, covering the lower half of the corolla, while the stigma projects on a narrow style.

PISTILLODES AND FILAMENTS ASSIMILATED

In striking contrast with the broad peltate pistillode of the dwarf *Neanthe* palm, the pistillode of *Edanthe* in the dry state is much like the filament in size and shape, narrow and columnar, tapering slightly from an abruptly broadened base to a somewhat obliquely truncate apex. The stamens are notably specialized in the apical attachment of the anther-cells. Different textures are indicated, the pistillodes being white in the dry state, and the filaments light brownish.

ANTHERS OPENING UPWARD

The attachment of the anthers at the top of the filament obviously is responsible for the direction of dehiscence,

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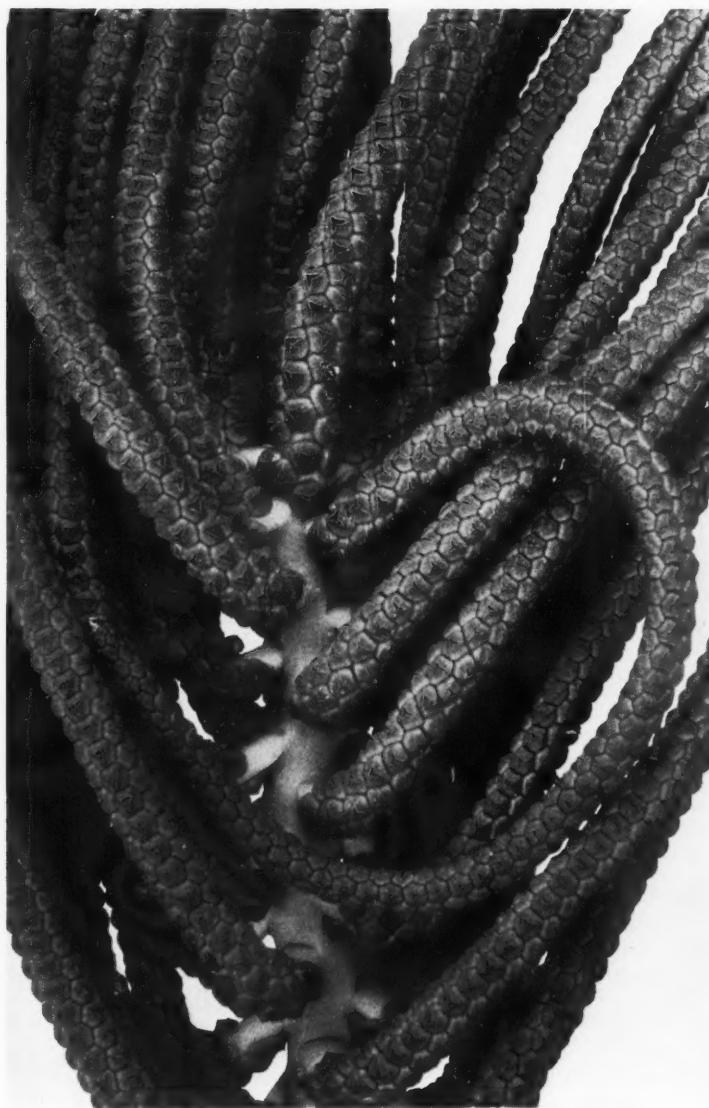


Figure 6. Axis, branches and male flowers, natural size.

which is upward, or distal to the filament, instead of the usual lateral position of the pollen cells, more or less parallel with the filament, facing inward, outward, or sidewise, the positional relations usually described as introrse, extrorse or lateral. The anther as a whole is short and broad, the two cells of each anther opening widely like small bivalves, and scarcely connected with each other except by being attached at the same point, somewhat above the middle. Thus the anthers might be described as versatile, with separate pollen-cells, no connective being apparent in the dry anthers, either above or below the attachment.

MALE CALYX SUPPRESSED

With the corollas of the male flowers forming a complete pavement over the branches of the inflorescence, the calyx no longer is a functional organ, and is reduced to a narrow rim, not appearing distinctly lobed or even widened in alternation with the petals. The calyx of *Stephanostachys casparyana* is shown in Oersted's drawings with very narrow attenuate lobes, and the calyx of *Stephanostachys wendlandiana* with short rounded lobes, these characters representing stages in reduction of the calyx, but carried further in Edanthe.

GENERIC CHARACTERS OF EDANTHE

Trunk solitary, taller and more robust than in other members of the family; leaf-sheaths very long, permanently closed, rather persistent; petiole usually shorter than the leaf-sheaths; leaf-blades broadly oval, inflorescences definitely infrrafiliar, usually 4-6 joints below the leaves, compound in both sexes, with numerous simple branches. Male inflorescences of fleshy texture with a short axis and 5 or 6 spathes, two complete, not opened until the flower-buds are mature; staminate

flowers tesselate, forming a close pavement completely covering the surface of the branches; calyx obsolete, reduced to a narrow concealed rim; male petals broadly triangular, applanate-geniculate, valvate; stamens 6, standing wide apart, filaments rather short, columnar, tapering slightly from an abruptly broader base, anthers short, attached above the middle to the tip of the filament, opening distad; pistillode rather slender slightly tapering, truncate, in form and size assimilated to the filaments. Female inflorescences with much smaller spathes, attaining only the lower branches of the long emergent axis; pistillate flowers seated in distinct cavities of the branches, rather remote, often separated by 2 or 3 times their diameter; calyx distinct, with 3 short broad lobes, somewhat overlapping; petals broadly triangular-reniform, slightly apiculate or emarginate at the tip, broadly imbricate; the margins thin, translucent; pistil broadly turbinate-conic, only the short three-lobed stigma exposed; fruits broadly ovate, with a thin outer pulp and a thin fibrous mesocarp. Seeds ovate, pointed at base, albumen uniform, embryo dorsal, slightly below the middle.

The type species, *Edanthe veraepacis*, is the largest and most robust of the Central American Chamaedoreaceae, with trunks 6 to 9 cm. thick and very large many-branched inflorescences in both sexes.

Edanthe is related to *Stephanostachys* Klotzsch and *Spathoscaphe* Oersted, but the types of these genera are relatively small, slender palms with trunks only 2-3 cm. thick, and the pistillate inflorescences are reduced to a simple axis or to a few short branches with the flowers densely crowded. Two of the species placed by Oersted under *Stephanostachys*, *S. wendlandiana* and *S. tepejilote*, appear to be very different from the type species, *S. caspary-*



Figure 7. Male and female flowers, enlarged.

ana, which is a slender short-trunked palm with leaf-blades only 3 feet long, inflorescences only 5 to 7 inches long, the branches few and short, less than 3 inches long, and the flowers of both sexes set close together, but the calyx not suppressed as in *Edanthe*. Oersted's drawing shows the calyx of *S. casparyana* with narrow attenuate lobes, several times as long as wide. The calyx-lobes are short in *S. wendlandiana*, but the female flowers are congested as well as the male flowers, the fruits in Costa Rica are "bright orange," according to Standley, and only one spathe is greatly enlarged and long-pointed, in his material.

EDANTHE VERAEPACIS, NEW SPECIES

Trunks solitary, 5-6 meters tall, often braced or supported on masses of thick superficial roots, 1.5 cm. in diameter; internodes commonly 4-8 cm. long, sometimes 10-20 cm.; 6-9 cm. thick. The lower trunk sections are somewhat longer than wide and somewhat narrowed at the base, with strongly developed leaf-scars.

Leaf-sheaths attaining a length of 60 cm., the leaf-sheath bundle notably thicker than the trunk; petiole 37 cm., longer in forest palms, to 70 cm., 2.4 cm. wide, shorter and thicker in open places; leaf-blades attaining 2 meters by 110 cm. in shade-grown palms; rachis 160-170 cm. with a conspicuous white vitta below, about 1 cm. wide; pinnae on each side 31-39, attaining a length of 65 cm., and a width of 6.5 cm., with 4-5 prominent veins on each side, scarcely smaller than the midrib. Lower pinnae separated by 4.5 cm. in shade-grown leaves, but approximate or even overlapping on palms grown in the sun. Texture of pinnae coarse and heavy in open-grown leaves, with a distinct grayish bloom on the under side. Forest-grown leaves are darker in color and the two sides less differ-

ent. Also the pinnae of forest-grown palms remain nearly horizontal, while those of open-grown palms become pendent. The upper pinnae are gradually shortened, to about half the length of the middle pinnae, the terminal pair narrow, though often notably wider than the subterminal, as shown in figures 1 and 2.

Male inflorescences on short thick peduncles bearing 5 or 6 spathes; lengths of successive joints in centimeters, 1.5, 1.8, 2.2, 3, 3.8, 6.5, 3; third spathe 30 cm. long by 10 cm. broad, fourth spathe 61 cm. long, 9 cm. broad, opening to 12 or 13 cm., fifth spathe 55 cm. long; the fourth and fifth spathes complete, enclosing the sixth, and with space at the end for continued growth of the branches, which thus remain covered until just before flowering; sixth spathe triangular, bract-like 16 cm. long, 4 cm. broad at base, tapering to a sharp point. Exposed surfaces of mature spathes slaty olive, the enclosed spathes pale green.

The two large spathes open by splitting along the outer, lower side, are of rather soft texture and soon deciduous or marcescent. Flowering axis of male inflorescence 35 cm. long, with about 90 branches, simple or rarely dichotomous, basal branches 27 cm. long, middle branches 24-25 cm., terminal branches 21 cm., the branches turning backward at the base as the inflorescence opens; branches completely covered with flowers, except for a short space on the upper side at base, these areas and the axis pure white. Flowers arranged usually in 6 longitudinal rows, sometimes in spirals, as on the axis in figure 6; flowers hexagonal, greenish yellow at first, becoming citron yellow, anthers light brownish, pollen white or pale bluish. Texture of petals rather fleshy, but not thickened toward the base as in the female flowers. The two lower petals meet on the vertical line, that is,



Figure 8. Female inflorescence at flowering stage.

along the axis of the branch and in line with the middle of the third petal. Pistillode moderately robust, clavate-truncate in the fresh state, the apex with three distinct grooves.

Female inflorescence with a total length about 70 cm.; peduncle 7-jointed, the lengths in centimeters, from the base: 1.7, 0.3, 0.9, 1.2, 2.6, 7.3, 5.5, the widths about 2 cm.; spathes of third joint 9 cm. long, of fourth joint 18.5 cm., 4.2 cm. wide; of fifth joint 23 to 34 cm. long, 3.7 cm. wide; of sixth joint 4.5 cm. long; axis 23 cm. long, terminal section 19 cm., lower branches 23 cm., middle branches 20 cm.; subterminal branches 17 cm.; the branches not decurrent on the axis, sometimes subtended by a bract 1 to 1.5 cm. long, often crumpled against the branch; axis often provided with a few flowers below the insertion of the last branch; number of branches 23 to 38. Color of axis and branches light oriental green (Ridgway, 18), flowers greenish yellow.

Female flowers broadly turbinate, arranged in open spirals; calyx distinct with slightly overlapping lobes, the margins soon drying and turning brownish, forming a dark ring around each flower. Petals greenish yellow, not becoming clear yellow like those of the male flowers, broadly imbricate, slightly apiculate, exposing little more than the short recurved stigmas; texture of petals fleshy, thickened gradually from the margins to the base. Calyx also somewhat thickened, especially at the rim of the depression. Much of the calyx is concealed as a lining of the depression in which the flower is seated. Staminodes are represented by only a minute rudiment in front of each petal.

The flowers of both sexes had a very penetrating, pungent odor, and were visited by great numbers of a small black Thrips, but no secretion of nectar was observed. The surface immediate-

ly around the stigma appeared somewhat glandular, but the staminodes were dry. The pollen sifts out readily and is adapted for distribution by the wind. This may be the significance of the narrow openings of the flowers, to lengthen the period of distribution by the wind.

A tendency was noted to more numerous spathes on the female inflorescences, although the fourth spathe sometimes is much shorter than the fifth, and not complete. In other cases the sixth spathe may be larger than the fifth, or projecting somewhat beyond it, due partly, no doubt, to the continued growth. Some of the female inflorescences have the lower branches subdivided, sometimes with 3 or 4 secondary branches. Apparently dichotomous divisions of branches also occur occasionally. The crumpled bracts sometimes found subtending the middle branches of female inflorescences are another irregular feature.

The female palms fruit heavily, sometimes with 4 or 5 densely crowded clusters developing at the same time. Fruits rather long oval, flattened on one side above the aborted carpels; length 2 cm. or less, by 1.2 cm. in diameter, broadest near the middle; stigma-scar basal. Outer skin green until full grown, not yellow at any stage, becoming dull purplish black, enclosing a watery yellowish green pulp, the seed shooting out under pressure like a cherry-pit.

Seed shaped like the fruit, 1.5 cm. or less long by 0.9 cm. in diameter. Outer surface smooth except for slight impressions made by the fibers of the raphe.

Seedling with simple leaves, broadly v-shaped.

Type specimen is No. 862350 in the National Herbarium, collected in May 1914, at Coban, Alta Vera Paz, Guatemala. Other material, including



Figure 9. Female peduncle, branches, fruits and seeds, natural size.

photographs, was obtained at Coban in 1904, also at Sepacuité, in the district between Senahu and Cajabon, in 1902 and 1905.

The name Vera Paz, the Latin *Vera Pax*, meaning True Peace, commemo- rates the missionary exploit accom- plished in this district by the great Las Casas, which saved the native peoples of the continent from being enslaved and exterminated, as already had oc- curred in Haiti and Cuba. Las Casas undertook in 1537 his peaceful con- quest of the savage mountain tribes, by learning the Quiché language, writing Christian songs in the native manner, and teaching them carefully to native trader-musicians, thus gaining peace- able access to hostile chiefs, who in a few months "yielded themselves peace- ably and without resistance to the gov- ernment of Spain." This demonstra- tion that the natives were human en- abled Las Casas to obtain from Charles V in 1542 the final decree forbidding the enslavement of the Indians. In the Vera Paz country the native life and arts remained but little disturbed, most of the natives still living in family groups scattered upon the land, and depending almost entirely upon their native food plants. Thus the Vera Paz pacaya may have a symbolic interest, in addition to being planted as a tree- crop or as an ornamental palm.

EDANTHE TEPEJILOTE (LIEBMANN)

A second species of Edanthe may be recognized in a palm from Mexico treated by Oersted in 1858 as *Stephanostachys tepejilote*, first described as *Chamaedorea tepejilote* in Martius, *Historie Naturalis Palmarum*, 3:308. It is represented in the Plant Introduction Garden at Coconut Grove, Fla., by several palms grown from seed col- lected by Dr. A. C. Purpus at Zucua- pam, Huatusco, Vera Cruz, in 1928 and 1929. A comparison was made in

April 1932, when male inflorescences were not available but from the char- acters of the leaves and those of the female inflorescences it is plain that the two species are distinct, the Mexican palm being somewhat smaller, with shorter and relatively broader leaves, fewer pinnae, and the strong secondary veins fewer and wider apart.

Comparing pinnae of the same length, 37 cm., those of *tepejilote* are somewhat broader, nearly 6 cm., with *veraepacis* less than 5.5 cm., and nar- rowed more above the middle. Thus at 25 cm. from the base the pinna of *veraepacis* is 3 cm. wide, and that of *tepejilote* 4.5 cm. Only four secondary veins are distinct in *tepejilote*, two on each side of the midrib, one intermediate vein and the submarginal vein, or 5 prominent veins in all, 11 to 14 mm. apart, while in *veraepacis* 8 or 9 veins are prominent, 5 to 7 mm. apart. The submarginal vein in *tepejilote* is 4 mm. from the margin, in *veraepacis* 2 to 3 mm. Specimens collected by Liebmamn in Oaxaca in 1842 are in the National Herbarium, and show a similar vena- tion, but the pinnae are narrower, only 3.5 cm. wide in the dry state.

The female inflorescence measured 49.5 cm. long, with 11 branches, the peduncle 24 cm. long, axis 13 cm., ter- minal section 12 cm., lowest branch 14 cm., the next 15 cm., peduncle 7- jointed, the lengths in centimeters 0.4, 0.3, 0.7, 2.5, 6.5, 7, 6, the lower joints nearly 2 cm. wide, the upper 1.2 cm., spathe of second joint 5 cm. long, of third joint 10 cm., of fourth joint 14.5 cm., of fifth joint 17.5 cm., sixth and seventh joints without spathes.

Regarding this introduction, distributed under Numbers 77621 and 80881, favorable reports were received from Jacksonville, Fla., also from Cocoa, Orlando, and Miami, with sev- eral critical notes: "Sunburns even in

the winter, but does very well in shaded places," "leaves very long and rich-looking," "beautiful, fast-growing, healthy," "among the most beautiful palms I have ever seen," "especially fine as a tub specimen."

It is possible that this species may prove somewhat more hardy than the other. Hybrids were made a few years ago and are growing at Coconut Grove.

The principal reason for not placing Oersted's *Stephanostachys wendlandiana* in Edanthe is that the female inflorescence is much reduced, only six or seven branches, three inches long, with the flowers close-set and six-ranked like the male flowers, instead of these specializations being limited to the male sex. The original account of *wendlandiana* includes seven chartaceous spathes, the fifth and sixth 10 inches long, the seventh smaller. Shorter and less numerous spathes are indicated in *Chamaedorea exhorrriza* Wendland, as described by Guillamin in 1922, and the calyx is not toothed. The original localities of *exhorrriza* and *wendlandiana* are not definitely known, both being described from conservatory palms which may have been stunted or abnormal. The urceolate male calyx of *Chamaedorea alternans* Wendland, from Chiapas, Mexico, indicates an association with Spathoscaphe, rather than with Edanthe or Stephanostachys.

Although it is customary to depend on floral characters for distinguishing genera of plants, there is no biological reason why any distinctive feature of trunks, leaves, or inflorescences should not afford diagnostic characters, the other features often being as definitely specialized as the floral organs and more accessible to field observation. The palms are still in the early stage of taxonomic treatment, with adaptive

specializations on different lines from most of the other orders.

The notion of plants being named and identified from brief conventional diagnosis without being studied in detail is a heritage from the early period of botanical history when the familiar European flora was being classified. With each differential feature that is recognized terms must be chosen and adapted to the purpose, before suitable definitions can be formulated, that will not be ambiguous and misleading.

The English language has facility in readily incorporating new distinctive terms from the Latin or Greek languages, whence most of the technical vocabulary of botany is derived. In essentially the same way that the Romans incorporated an extensive Greek vocabulary into the Latin language, the structure of English permits the direct use of Latin and Greek terms, without confusing substitutions or modifications required in other languages. If we say that Edanthe is characterized by tesselate flowers and a rudimentary calyx, the meaning is as plain to any Latinist as "flores tesselatae calycibus rudimentiariis," and does not terrify the general reader.

Adequate illustrations of essential features bring us much closer to identifying our plants than any amount of verbal definition, and protect us from the danger of botany being narrowed to an esoteric science, limited to a few herbarium adepts more concerned to write Latin than to know the living plants. It seems unfortunate that our school system has debased and largely suspended the study of Latin and Greek, but this handicap may be temporary. The language needed to express scientific distinctions may be recognized as a part of scientific education.

Useful Small Bulbs

DORETTA KLABER

WHEN we look through bulb catalogues, often somewhere toward the back, ignominiously labeled "Miscellaneous," we will find listed some of the most delightful flowers we can grow. They are the small bulbs, corms and tubers, many of which open the gardening year, appearing in January, February or March, closing or drooping in a bad spell of weather, opening again gayly when the sun shines, and so encouraging us through the last difficult weeks of Winter. There are varieties which carry us on into the high tide of Spring, and still others that appear in Autumn in surprising contrast to the majority of bloom at that season.

The familiar snowdrops and snowflakes used in patches or drifts on a bank, or clustering along the edge of the woods, and in and out among the trees, have the appearance of lingering drifts of snow. For bright sunny patches in the woods, *Eranthis*, the Winter Aconite, counteracts the cold look of the white flowers, and it's golden buttercups set flat on a ruff of shining dissected leaves, bloom for a long time. Liking the same conditions of woodland or path side, or under and among shrubs, there are the lovely blues of scilla, chionodoxa and muscari. Muscari, or grape hyacinths, follow close upon the scilla in time of bloom, so that an interplanting of the two will give a long season of their blue and purplish tones, and for the short time while they are both in bloom they show the iridescent quality of stained glass. There are, of course, lovely white varieties.

Most of these bulbs will adapt them-

selves to sun or shade, some of the scillas doing particularly well even in deep shade. They should all be planted in pools and rivers, or foaming like spring freshets around some rocks. Hepaticas, anemones, violets, and all the rest of our wild woods flowers and ferns should be associated with them, for contrast and succession of bloom, to cover the dying leaves of the bulbs and to fill in spots that would look bare or weedy later.

The early wild crocus also start blooming in the late Winter. Here we have colorings of white, gold, lavender, purple. One of the best is "Susianus," the Cloth-of-Gold crocus. It's brilliant star shaped flowers come in clusters and appear and reappear in a most heartening manner.

The rock garden or an equally warm exposure with loose friable soil is the best location for these charming bulbs, but they are really not very fussy. All should have a ground cover of creeping plants such as *Veronica repens*, *Gypsophila repens*, small sedums, etc., or be interplanted with arabis and aubrieta, pinks, and so on, whose flowers will follow them and whose foliage will cover the bare spots. Some of the later bulbs, such as *Scilla hispanica*, and species tulips bloom with these early flowers, so should also be planted nearby. In fact, if you can so arrange it that all your little bulbs are planted in the same general neighborhood, and as many of the early blooming shrubs and trees nearby as possible, such as jasmine, benzoin, shadbush, wild plum, cherries, crabs and dogwoods, you will be able to create many gay early pictures.

Among the narcissus there are a group of exquisite miniatures. Among the tulips, the species or wild varieties, while not all small, are not so well known as they should be. An interesting group, comparatively little grown in gardens, erythroniums have variety of color and great charm. Many are native to California, but almost every section of the country has its wild variety. The brodiaeas and calochorti of California have been considered difficult in other sections of the country, but they have been known to grow and bloom, and should be experimented with. Only by trying out the various plants under the conditions that we can give them, by studying their needs and peculiarities, can we hope to increase our horticultural knowledge.

Following is a partial list of species and varieties we can grow:

RANUNCULACEAE

ANEMONE is a large and enchanting family, ranging from the small early spring blooming woodland and alpine species, to the tall late fall blooming *Anemone japonica*, one of our best hardy perennials. Of the small ones with tuberous or bulbous roots, we have:

Apcnina. Very early indeed the lovely starry sky-blue flowers of this tuberous species will delight you.

Larger in flower than our native hepatica, this Italian species with divided toothed leaves, likes much the same woodland conditions. There are white, pink and dark blue forms.

Blanda, a charming species from Greece, has still larger flowers than *apennina*, of a more brilliant blue, like large daisies with a small golden center, while the plant itself is neater, smaller and fleshier leaved. *Blanda* has too, white, pink and purple forms. It opens best in brilliant sun and should

be surrounded by other choice plants, as its foliage dies down soon after blooming.

Sylvestris the European wood anemone is a lovely species which spreads from a running rootstock. It has deeply cut leaves, grows about eight inches high, has large white drooping fragrant flowers, and is a grand variety to naturalize in cool moist woods.

Carolinianum has large delicate white or purple silky flowers on a six inch stalk.

Less hardy are the taller *coronaria*, *fulgens*, and *hortensis*. Their poppy like flowers come in brilliant blue, red and purple colors, and while they have lost some of the grace of the smaller species, they are an interesting group and worth experimenting with.

ANEMONELLA: *thalictroides*: Rue anemone. Tuberous roots. One of the common but lovely anemones of our woods. The somewhat similar *Anemone quinquefolia* grows from a creeping rootstock.

RANUNCULUS *asiaticus* has fleshy roots usually sold as bulbs. They grow from six to twelve inches or more high, and are brilliant single or double buttercups in almost every color except blue. They can be grown outdoors with the same care as the coronaria type anemones, in a warm protected corner in loose soil.

ERANTHIS: winter aconite. Basal leaves palmately dissected, one stem leaf just below the large yellow buttercup which sits flat upon it. Very hardy, low and one of the very earliest of the Spring blooming bulbs, the bright yellow flowers of the winter aconite are particularly welcome. They do well in woodland or under shrubs or in any shady corner with good soil. *Hyemalis* 5-8 inches is the earliest, coming up as soon as frost is out of the ground; *cilicica* is a few weeks later.

OXALIDACEAE

OXALIS: Wood-sorrel. There are a few hardy varieties. *Violacea* 5 petalled, low rose purple umbels, with the typical clover shaped leaves. Woodland. Two species for a protected position in a rock garden are *enneaphylla*, large white solitary cup-shaped flowers with lavender veins only two or three inches high, with glaucous blue finely folded foliage, and *adenophylla* with lilac pink flowers, several to a stalk and similarly folded foliage.

PRIMULACEAE

CYCLAMEN: Sow-bread. We are inclined to think of cyclamen as greenhouse flowers, but there are hardy species which should prove real adventures.

Coum is a small species blooming in Spring. It likes woodland conditions, with lime in the soil, has very dark green leaves, and magenta flowers of the typical winged cyclamen form.

Europaeum is the most attractive of the hardy species. It blooms in fall with dainty fragrant bright carmine flowers, four or five inches high; has delicately marbled leaves and likes a gravelly soil in sun.

Neopolitanum also blooms in fall, the flowers appearing before the leaves, which are ivylike, dark and marbled, while the flowers with their sharply folded-back petals vary from white to rose.

In the last number of this magazine the method of raising Cyclamen from seed was described in detail.

IRIDACEAE

IXIA: Corn-lily, from the Cape of Good Hope. Can be grown in the North with protection, full sun, and the covering lifted gradually in the Spring. They have long narrow grass-like leaves, and spikes one to two feet

tall bearing six to twelve gayly colored flowers, ranging from white through yellow, lilac, pink, crimson, red, purple, and green. The flowers open in full sun and close at night or on cloudy days. They start out cup shaped and gradually open wide into a six-pointed star. A few of the species are, *odorata*, fragrant, yellow, *monadelpha* lilac, *viridiflora* pale green with black throat, *maculata* yellow with dark purple throat.

IRIS. Among small bulbous iris we have the *reticulata* group, so called because of the netted coat on the bulbs.

Reticulata blooms in March or April, very dwarf with violet scented lavender blossoms. Similar, but of a velvety crimson is *Krelagei*, listed as a variety, as is *histrioides* which frequently blooms before the leaves with lovely delicate lavender-blue blossoms. Extra early is *Bakeriana* 3-6 inches with intense violet flowers, and *Danfordiae* only 2-4 inches high, with tiny bright yellow fragrant flowers.

The group known as *Juno* irises are mostly taller than the foregoing.

They are distinguished in the bulb by their fleshy radish-like roots attached to the lower part of the bulb. These roots are very brittle and make this group difficult to transplant. Here we find a small one, *persica*, a very early delicate little flower of lilac with purple lines and spots; *orchioides*, taller with yellow flowers with a purple blotch, and others.

There are, of course, among the bulbous iris, the better known and larger Dutch, Spanish and English forms.

In addition there are many other dwarf and slender irises of exquisite beauty, most of which can be grown from seed, and though they are rhizomatous should at least be mentioned with this group. *Pumila*, the dwarf bearded iris in yellows, blues, purples,

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Winter Aconite, *Eranthis hyemalis*.

and whites; *cristata* and *lacustris*, the tiny crested blue or white irises; *verna*, blue, violet and gold; *arenaria*, golden; *gracilipes*, pale lavender and gold; and others.

CROCUS: Here we omit the large Dutch hybrid crocus, which seems to grow larger and fatter and more breathtaking every year, and pass on to the wild sorts. These are divided into Spring and Fall blooming, and all are to be desired.

The Spring bloomers come in the crocus colors of clear lavender and purple, gold, white, and striped. *Imperati*, the earliest, which means very early indeed, is buff outside, a beautiful star of lavender purple when open; *biflorus*, the Scotch crocus, comes in many variations of white, lavender, and purple stripes; *chrysanthus*, deep yellow; *Fleischeri*, white pointed petals with lilac lines on back, orange anthers; bright orange-yellow *Korolkowii*; *Sieberi*, lilac, white or purple striped; *Susianus*, the well named "Cloth-of-gold"; *Tomasinianus*, pale bluish red; *vernus*, similar in coloring to *Sieberi*; *versicolor*, pale or dark purple, often feathered.

The Fall bloomers have no yellow varieties. They have delicate flowers appearing before the leaves and are easily injured. *Sativus*, the saffron crocus, has bright lilac flowers, yellow anthers and bright red style branches, which is the source of saffron. *Speciosus* is lilac, feathered darker; *zontatus* is rosy lilac, purple veined. There are many others.

AMARYLLIDACEAE

NARCISSUS. Among the small species we have:

Bulbocodium citrinus, sulphur yellow, and *conspicuus* rich golden yellow, only 6 to 8 inches high. They have rushlike foliage, and the frilled

spreading trumpet give them the common name of hoop-petticoat daffodil.

Cyclamineus has a very drooping flower with a narrow deep yellow crown and a perianth of a paler yellow as long as the crown, sharply reflexed, so that it looks as though blown back by a strong wind.

Jonquilla, one to one and a half feet tall, rushlike leaves, 2 to 6 flowers on a stem, fragrant, deep yellow with a very short crown; var. *minor* is a more dwarf form.

Triandrus is pure white in the type, with horizontal or drooping flowers, the trumpet half as long as the reflexed perianth. There are varieties ranging from pale to deep yellow. Their perianth is not as sharply reflexed as cyclaminuem, but they too are appropriately called cyclamen-flowered.

Pesudo-narcissus var. *minor* is a trumpet narcissus, and has an inverted cone-shaped yellow crown, and sulphur yellow perianth, the flowers being about one inch long. The var. *minimus* is the smallest and earliest of the trumpet daffodils, with the attraction of all miniatures.

Juncifolius is a slender species 6 to 12 inches tall with a short crown of deep yellow and a starry perianth. There is a smaller variety, *minutiflorus gracilis*, about one foot high, with slender rush-like leaves and pale yellow, late-flowering jonquil.

LEUCOJUM: Snowflakes. Blooming in March or earlier is *vernus*, with 6 even perianth segments, which is one way of distinguishing it from the snowdrop in which outer and inner segments are uneven. This is known as the Spring Snowflake, blooming about a month later than the snowdrop, and the stems 6 to 12 inches high carry but one flower, white tipped green, bell shaped and drooping. A variety *carpathicum* has segments tipped with yellow, and is very lovely.

Aestivum is called the summer snow-flake, although it blooms only a month or so later. Flowers white, tipped green.

There are some other species.

GALANTHUS: Snowdrops. There are a number of species: *nivalis* is the common spring snowdrop, with solitary drooping white flowers, inner segments tipped green; a variety *flavescens* has yellow instead of green markings, and var. *reflexus* has outer segments reflexed. *Elwesii* is the giant snowdrop, larger than the preceding and much earlier.

Other species differing slightly in form or coloring, or greatly in time of bloom, are: *plicatus*, March and April; *graceus*, April; *latifolius*, May; *cilicicus*, blooming in fall, etc.

STERNBERGIA: *lutea*. Leaves strap-shaped, lasting all winter, becoming one foot long, or longer than the funnel shaped upright yellow flowers, which somewhat resemble a crocus. Blooms in Fall.

Fischeriana has larger flowers and blooms in Spring.

Colchiciflora and *macrantha* develop leaves in Spring and flower in Fall.

LILIACEAE

BRODIAEA: Leaves grass-like, flowers usually tubular, in many flowered umbels. Purples, reds, whites, and yellows. Well-drained soil, protection in cold climates. Bloom during May, June and early July.

Californica, with rose to purple flowers, one to two inches long, is considered the best garden variety. Showy and one of the best is *laxa*, with many broadly tubular purple flowers; *Howellii* var. *lilacina* is a very handsome porcelain-blue variety. Other good ones are *ixioides*, yellow; *hyacinthina*, milky white, *rosea*, a pretty rose-red species; *stellaris*, bright purple with

white centers, and *gracilis*, a tiny yellow species.

ALLIUM: onion tribe. There are a number of species grown for their flowers, but all except *neapolitanum* and *fragrans* have the characteristic odor. *Moly*, with round heads of golden yellow flowers, grows about eight inches high, and blooms in Spring; *cernuum*, rose colored or white in nodding umbels, early summer. From the Alleghenies and west. *Neapolitanum* needs protection. Large heads of pure white flowers with colored stamens.

There are many others from the west and from abroad.

SCILIA: squills. *Sibirica*, one to three drooping flowers, three to six inches, in intense blue or white. Indestructible and of rapid increase. Early Spring.

Nutans, the English bluebell, with nodding shepherd's-crook stalks of hyacinth-shaped flowers, blooming in May, in blue, pink or white.

Hispanica (*campanulata*) wood hyacinth. Blue, pink or white drooping bells. These are taller than *sibirica*, bloom in May and can be combined with all the May-flowering trees, shrubs, and flowers, planted either in the garden or naturalized in the woods.

Chinensis, a good species for the rock garden, as it needs some protection. Delicate spikes of rose-colored flowers blooming in June.

Autumnalis, rose-colored flowers blooming July-September.

Bifolia, one of the best, a low species blooming in March with blue flowers. There is a variety *alba*, white-flowered, *rosea*, pink-flowered, *ruberrima*, red-flowered, and *splendens*, intense cobalt blue.

ORNITHOGALUM; Star-of-Bethlehem. *Umbellatum*, racemes of 12-20 flowers white on upper side, green on back, margined white, blooming in May, about 6 inches high. Spreads

rapidly and should be placed where it can run wild. *Nutans* has spikes of larger nodding flowers.

MUSCARI: Grape hyacinths. The chief characteristic of the grape hyacinth is the contracted mouth of the urn-shaped flower. Some have spikes of oblong flowers, some oval or round flowers. The best known of these is

Botryoides, which has drooping purplish-blue bells with a toothed white edge at the narrow mouth. There is a larger blue form "Heavenly Blue" and there are flesh and white varieties.

Heldreichii belongs to this group but has larger flowers standing horizontally on the spike, with a conspicuous toothed white edge.

Pallens is especially dwarf, with close heads of white or pale blue flowers.

Parviflorum has pale blue bells blooming late.

Racemosum is typical of the oblong-flowered group, with rush-like leaves lying on the ground, and a dense egg-shaped spike of dark blue flowers.

Neglectum is larger in all parts than *racemosum*.

Szovitzianum has several racemes of long bright blue flowers.

Lingulatum is also known as *Hyacinthus azureus*, and is one of the loveliest of the early bulbs, coming before the other muscari and differing, too, in having wide open flowers. They bloom in a tight cone of azure blue.

There are additional species.

CHIONODOXA: Glory - of - the - snow. These grow 3 to 6 inches high, with 6 to twelve soft blue starry flowers, petals slightly reflexed, on each stalk.

Luciliae is the form most generally grown, holding its flowers erect so that you look down at their blue faces centered white. There is a white form. Indispensable among early bulbs.

Sardensis, deeper blue, smaller flow-

ers, without white centers. One variety has black stamens, another white.

Grandiflora, slaty blue, with white forms, and, rarely, pink. Largest flowers.

Tmolisii, much like *Luciliae*, but deeper blue and later flowering.

There are a group of hybrids of scillas and chionodoxas known as chionoscillas.

PUSCHKINIA: Lovely bell-shaped flowers of a pale greenish blue, bloom in early Spring on racemes 4-12 inches. *Scilloides* is the type, with var. *libanotica* larger.

CALOCHORTUS: Mariposa lily: Globe, Star and Butterfly tulips. With some protection and a loose friable soil many of these lovely flowers should succeed. There are many species and varieties, with time of bloom extending over three months in the Spring. To name only a few in each group:

Globe Tulip, so-called because of the more or less nodding rounded flowers. These are woodland plants one to two feet, with one long shining leaf from the base, and slender, graceful, leafy stems. Soft tints characterize this group.

Albus, satiny white, delicately fringed flowers. Var. *amoenus*, rose-colored, more slender than the type.

Amabilis, stems usually branching in pairs, flowers clear yellow.

Star Tulip, bell-shaped, erect when open, usually smaller than the Globe Tulips, with dainty open cups, mostly white, streaked or dotted with other color.

Marceanus, 3-10 inches, a slender plant with milky white flowers, purplish at the base.

coeruleus: here the white flowers are lined and dotted with blue.

Benthamii—the only yellow in this group. Claw of the petal brown, and in the var. *Wallacei* dark red or nearly black.

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Grape hyacinths, *Muscari armeniacum*.

Giant Star Tulips hardly belong among "small bulbs." They are a foot or two high with large upstanding bell-shaped flowers, still silky and delicate in appearance. They grow in open sun. *Tolmiei* remains in bloom a long time, white tinged lilac; *apiculatus*, straw-colored flowers; *Purdyi*, handsome creamy white, purple tinged.

Known as *Meadow Tulips* is a small group found growing in wet meadows. They will grow in any well drained soil.

Uniflorus, a clear lilac delicate flower, 4-8 inches high, is typical of this branch.

Mariposa Tulips: Between the giant star tulips and the true

Butterfly Tulips—there are a number of hardy species from Oregon to Montana. They have glossy broad leaves and delicate cup-shaped blooms. *Nitidus* is a showy species varying in color: white, yellow, lilac, with an indigo blotch in the center.

We then come to the true mariposas or *Butterfly-Tulips*—*Weedii*, orange colored flowers, dotted purple, triangular petals, square topped; *purpurascens*, a showy lilac species; *clavatus*, the largest and strongest of the mariposas, the flowers huge bowls of yellow: *luteus*, var. *robustus*, white tinged with browns and purples, is one of the hardest; *Vesta* varies from white to purple with maroon markings, and is one of the showiest and most easily grown; *venustus*, var. *Eldorado*, is considered the loveliest of the Butterfly tulips. Varies in color, white, pink, lilac, purple, red, and light yellow, with contrasting blotches and markings.

LILIMUM pumilum, (formerly *tenuifolium*) is the brilliant little coral lily, with its Turkscap type flowers, growing about 18 to 36 inches high.

Concolor or star lily, one foot to eighteen inches; blooms in late June, July, with several 2 to 3 inch bright

crimson flowers, sometimes dotted dark purple. Somewhat similar, but blooming earlier, is *pulchellum*; *cernuum* is two feet high with lovely pink flowers.

TULIPA: The wild or species tulips will be the only ones considered here.

Clusiana, the well known candystick or Lady Tulip, with its delicate pink and white striped flowers, blooms with Poet's Narcissus, *Scilla campanulata*, flowering trees and shrubs.

Persica has fragrant yellow flowers, very late. *Australis*, *biflora*, *chrysanthia*, *dasystemon*, *linifolia*, *Marjoletti*, *sylvestris*, *Wilsoniana*, to name but a few of them. Most of them are from one to eight inches high, and vary in color from white through rose to red, and from pale yellows to oranges. Almost all of them are suited for rock garden or similar conditions, but will grow in any well-prepared soil.

FRITILLARIA: Fritillary, has many species, among which are *meleagris*: Guinea-hen flower or checkered Lily. Bloom early on stems a foot or more high, with drooping bell-shaped flowers with pointed petals. They come in whites, dull purples, and yellows, checkered or marked with contrasting colors. They are pleasant to naturalize in light woodland or meadow.

Pudica from the West is small, from 2 to 10 inches, usually yellow, rarely purple, not checkered and is fragrant. Sandy loam and some shelter.

Aurea, six inches to a foot with golden bells, purple checkered.

Plurifolia, 6 to 12 inches, has racemes of rosy purple flowers, not checkered. Loamy soil, light shade.

Purdyi is similar except for white flowers tinged purple.

Liliacea is a small Californian, white, veined green flowers funnel to bell shaped. Sun.

Coccinea—the scarlet fritillary is slightly mottled yellow.

Recurva from the Coast is distin-

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Chionodoxa Luciliae

guished by its narrow bell shaped flowers, bright red outside, and brilliant yellow inside, spotted red. It grows from 6 to 12 inches high, and needs a light sandy loam, and in common with others from the West Coast is not easy to establish, not always blooming the first year.

An early blooming species is *camschatcensis* from Siberia and Alaska; has dark wine purple flowers six to eighteen inches high; called the black lily.

ERYTHRONIUM: Dog's - tooth - violet. The erythroniums should be much more generally grown than they are. Their beauty is the sort that repays close study, and good groups of the many kinds and colors in the woodland or in a shaded rock garden would be a delight for many weeks. They have the Turk's-cap lily form, some having petals more recurved than others, one to many flowers on a stem, six inches to a foot high.

Americanum is typical of the Eastern American species, with two broad mottled leaves from the base, and solitary yellow flowers, found growing in rich woods. Other Easterners are *albidum*, pinkish white; *mesochoreum*, lavender flowers, leaves not mottled, petals not recurved; *propullans* from

southern Ontario and Minnesota, with small green slightly mottled leaves and rose colored flowers.

The Western Erythroniums have few to many large strong flowers. *Grandiflorum* has leaves with no mottling, and bright yellow flowers. *Californicum* is one of the most satisfactory in cultivation, has many cream colored to light yellow flowers, often marked maroon at the base; *revolutum* opens white and gradually flushes from pink to purple. There is a lovely white variety, *albiflorum*; variety *Johnsonii* has dark rose flowers with orange centers and varnished foliage; variety *praecox*, mahogany mottled leaves, flowers white with orange centers; *Hendersonii* grows to 12 inches, pale purple, strongly recurved petals, with a very dark purple center; *Hartweggi* is a very early species, and can stand more drought and heat than the rest. It bears one to six pale yellow blossoms shading to cream at the edge. It can be propagated by offsets, in common with the European Dens-canis and varieties, and the eastern American species. Other western Erythroniums can only be propagated from seed. *Dens-canis*, 4 to 6 inches high, drooping flowers in shades of rose and lilac, strongly reflexed. This species likes sun and moisture.

Prolonging The Life of Lily Pollen

NORMA E. PFEIFFER

IN BREEDING work, it is essential that viable pollen be available. There is usually no difficulty in obtaining this when the two parent plants, bearing fertile pollen, coincide in blooming season. Lilies, however, vary in their time of flowering, with some forms, like *Lilium rubellum*, appearing in the garden as early as May and some completing flowering as late as October. Furthermore, there are tender species which are easier to cultivate, at least in some of America's geographical range, when treated as greenhouse plants.

Fertile lily pollen is known to remain alive under air-dry conditions for a few weeks. In order to make crosses between species blooming naturally at the most diverse possible intervals, it is necessary to store the pollen so that it retains its viability longer than those few weeks. Experiments have shown that the viability of pollen of different species of lily is retained under conditions that can readily be supplied without special laboratory equipment. Three chief factors are involved; first, darkness; second, a lower temperature than room temperature; and third, a favorable moisture content of the atmosphere in which the pollen is stored. A temperature of 40° to 50° F. such as is found in automatically controlled refrigerators and cool cellars proves satisfactory. The favorable moisture content may be achieved by the use of one of several chemicals in closed containers.

Fortunately, several salts are known which are easy to handle, readily available and inexpensive. Those recommended are magnesium chloride, calcium chloride and potassium carbonate.

Using any one of these, a solution is prepared such that an excess of the chemical remains undissolved in the water used. The pollen is placed in convenient containers so that it is exposed to the air over the solution. One may utilize small glass desiccators such as are listed in the catalogs of chemical supply houses; these allow for the solution in the lower portion, with a shelf arranged at a higher level, on which a wire netting may be placed. Vials or small dishes containing the pollen are placed on the netting. For small collections of pollen, gelatin capsules prove to be useful for the individual samples: the precaution that these are not touched by liquid must be observed, and it is wiser to place these capsules in open dishes rather than directly on the wire netting. There is also on the market a very light aluminum "Desicooler," more reasonable in price and smaller than the glass desiccators. In this case a glass dish to hold the solution would necessarily be placed in the lower portion, so that the solution and metal of the container would not come in contact.

Home-made devices which make use of such available material as a glass fruit jar can be constructed with a little ingenuity, on the same principle as the desiccator mentioned. The saturated solution must be freely in contact with the air which surrounds the pollen, and the container must be closed. The pollen should not be touched by the liquid.

Aside from the salts mentioned, certain concentrations of sulphuric acid also give favorable humidities for retaining the ability of lily pollen to ger-



Lily capsules, seed and seedlings, from pollen stored nine to twelve months. A. "Lilium auratum" capsules produced with pollen stored in a vacuum at 10° F. for twelve months. B. Similar capsules showing good seed set. C. "Lilium longiflorum" capsules from pollen stored in a favorable humidity at 40° F. for nine months. D. "L. longiflorum" seedlings, from seed produced with pollen stored nine months. E. Later stage of seedlings similarly produced.

minate and function. This is a more difficult chemical to handle than the salts mentioned, but where it is more readily available and sufficient care is exercised in making and using solutions, it can be utilized to advantage.

Storage in a vacuum at a similar low temperature or even lower (10° F.) gives excellent results, but requires apparatus not usually available to the amateur.

Another method of preserving the life of the pollen involves practically no equipment but is found to require a similar low temperature, about 10° to 14° F., which is not always easily supplied. This consists of wrapping the relatin capsules already containing the pollen in several layers of heavy paraffin paper. Results with similar storage at refrigerator temperature were not satisfactory, although a good set of seed followed storage at 14° F.

No matter which of the methods is chosen, it is recommended that the lily stamens be transferred from the flower to a dry, clean dish before the stamens open. This dish should be placed in

the dark till cracking occurs along the sides of the stamens and the pollen is released. Thereafter, the pollen may be separated from the stamen tissue and stored in a compact mass, or the pollen with stamen tissue may be stored in a rather loose mass to allow further drying to the favorable moisture content in the desiccator. With storage in a vacuum, only pure pollen masses have been used to date.

With methods such as these, it has been possible to retain the viability of pollen from different species of lily for the greater part of a year. Viability is determined in two ways, one a laboratory method by which the pollen is germinated on hanging drops of a medium containing sugar and gelatin. The other more convincing demonstration of ability to function is the application of pollen to a receptive stigma. In experiments using this way, capsules were produced with seed which germinated to a high percentage and formed strong seedlings.

Boyce Thompson Institute
for Plant Research, Inc.

Germination and Storage of Lily Seeds

LELA V. BARTON

WITH the increase in the popularity of growing lilies from seeds have come renewed requests for information as to the best methods of handling the seeds. Many lily seeds germinate readily and send up shoots the first season while others do not appear above ground the first season although producing small bulbs. It is with seeds of this second group that lily fanciers experience the most difficulty.

Experiments have been performed in the seed laboratory using seeds of six lilies of the so-called two-year forms to discover the cause of delay in germination. *L. auratum*, *L. canadense*, *L. japonicum*, *L. rubellum*, *L. superbum*, and *L. szovitsianum* were included in the study.

Germination tests made over a wide range of temperatures showed that all of these seeds required from three to

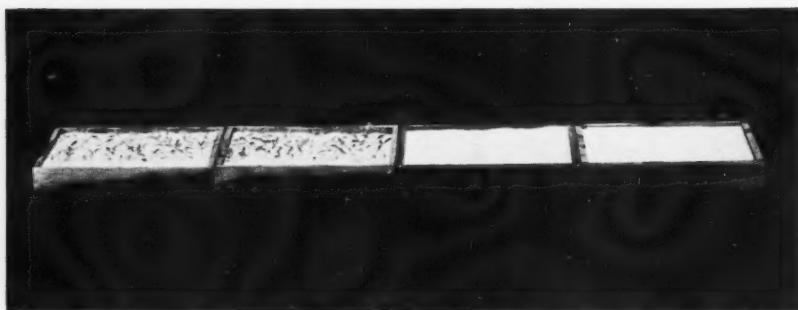


Figure 1. Effect of spring, summer, and fall plantings on seeds of *L. auratum*. In board-covered frame over winter. Photographed May 31, 1935. Planted 1934. Left to right: April, June, August, and September.

six months at a temperature of about 68° F. for the growth of the root which is non-dormant. However, the seedlings failed to produce shoots when they were allowed to remain in the greenhouse. This indicated the need of special treatment to initiate the growth of the dormant shoot. Seedlings with well developed roots were placed in rooms with temperatures of 33° to 50° F. It was found that an interval of six weeks to three months at these low temperatures was sufficient to break the dormancy of the shoot so that the first leaves appeared above ground promptly upon removal to the greenhouse.

Using this method, then, lily seedlings could be obtained above ground in less than a year if greenhouse and cold room facilities are available so that the seeds could be planted as soon as harvested.

Practically, spring or summer planting outside is the solution. Tests were made to show that seeds of *L. auratum* may be successfully planted outside any month during the year with the possible exception of August, September, and October (Fig. 1). However, a warm period must precede a cold period

before leaves will be formed. Late fall or winter plantings are not harmful but have no advantage since the seeds lie inactive until the advent of warm weather in the spring.

Growers are not agreed as to the importance of fresh seed for germination. It was found here that air-dry seeds of *L. auratum* kept well at temperatures of 33°, 41°, 50°, 68°, 77°, and 86° F. for five months but after twelve months, those stored at 77° and 86° F. had fallen off appreciably in germination. Seeds of *L. regale* with reduced moisture content have been stored successfully at room temperature for six years while air-dry seeds of the same species gave only one-half as many seedlings after two years of storage and all were dead after three years.

On the other hand air-dry seeds of *L. regale* can be kept with their original germination capacity for at least six years if they are stored in sealed containers at either 41° F. or below freezing. Reduction in moisture content was found to be unnecessary if low temperature storage was used.

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The Second Year with Autumnal Crocuses

ALFRED BATES

IN mid-April when all danger of a heavy freeze was past the pots of the autumnal flowering crocuses which were described in the July issue of 1938 were placed out of doors. Needless to say they had been carefully watered during the winter months spent in the unheated greenhouse and sprayed with Red Arrow whenever aphis appeared on their foliage. All were placed in full sun save *C. iridiflorus* which was given a position where only the morning sun could reach it. They were watered regularly until their foliage had died down; after that they were watered only when the pots were dry. In mid-August the earth above the corms was removed and fresh soil to which a liberal quantity of bone flour had been added filled in to the level of the rims of the pots. They were then sunk in various parts of the garden to a depth that would place the rim of the pot about an inch below the surface of the garden.

They were left in the pots in order to safeguard the increase, to facilitate the harvesting of the corms and to disturb them as little as possible and so approach second year conditions in the open garden as would have been had they originally been planted out of doors. This second year was to test out their hardiness and increase. Both of these points may as well be dealt with now. All came through the winter in good form but, as was to be expected in their second year, some did not flower and some of the very late blooming species blossomed under the snow for their withered blooms were found when the snow had melted. On the other hand several flowered more

profusely than they had the year before. At harvesting the increase was surprising; *C. C. karduchorum* and *longiflorus* yielded over sixty corms of various sizes and the increase from all the *speciosus* varieties was seven to nine fold. Of course some of the corms were very tiny and will need a couple of years to develop into blooming size but will, with careful handling, soon form goodly clumps in the garden.

There was a slight change in the order of flowering; comparisons may be made by referring to the report made in the July issue of 1938. The season began with *C. zonatus*; its first flower opened Sept. 27th and it continued to bloom until Oct. 14th. There were 16 blossoms from the five corms, one corm having died without issue as was discovered at harvest time. As a complete description was not given in the first report it will be made here. The flowers were a uniform height of 4½ inches and blossomed without the leaves. They were pale mauve (Ridgway's Color Chart is still being used), the veins were mauve at the base of the segments but become fainter in color as they reach the middle of the segment and are hardly noticeable by the time they reach the top. The throat is pinard yellow and the two dots on each segment which form the zone at the base of the segments are light cadmium. The anthers are white and the stigmata is light cadmium. Color effect in the garden is mauvette. I again noticed this year that among a clump in the garden which was not under trial there were several of a lighter and a pinker tone than any of the others either in the group or in the pot.

2. *C. speciosus albus* flowered from Oct. 6th until Oct. 30th at a uniform height of $5\frac{1}{2}$ inches and during this time gave 23 blossoms. It is truly a glorious mass of glistening white during the period of its heaviest bloom and even when only a flower or two is open draws the attention of all who see it. It is undoubtedly one of the best for the garden.

3. *C. speciosus Pollux* flowered from Oct. 6th until Oct. 30th at a height of from 6 to $6\frac{1}{4}$ inches and during that time gave 15 blossoms from five corms, later on the sixth corm produced leaves only. It is a very beautiful flower although it was not particularly outstanding the first year. In color the outside of the segments is light wistaria violet with very pronounced veins of Bradley's violet; the reverse or interior of the segments is almost a pallid purplish gray but with a more silvery tone than shown by the Ridgway chart and the veins are very faint and hardly noticeable. The throat is white; the anthers are deep chrome and the stigmata are orange chrome, both of which stand out in beautiful contrast against the color of the segments.

4. *C. speciosus Artabir* flowered from Oct. 7th until Oct. 19th at a height of 6 inches and gave 6 flowers from three corms, the others did not flower this year. This is a very lovely variety but there seems to be no uniformity in the color; while all flowers have the three outer segments darker than the three inner ones and less prominently veined, some of the flowers show a wider contrast than others. As the flowers age they become more uniform in color. Perhaps this variation was a peculiarity of one corm only for the other two were alike and the difference was not noticed the year before. One day old flowers from this corm were:—outer segments almost

pleroma violet but with a bluer cast, inner segments a very silvery pallid violet with veins of dull bluish violet and very pronounced against the lighter color. One day old blooms from the other corms had exterior of outer segments slightly bluer than lavender-violet with veins of pleroma violet, interior of segments lighter in tone; inner segments pale violet with main veins and the numerous fine ones of dull bluish violet (1) with the inner surface lighter in tone. They have a soft cloudy effect which is very difficult to describe. In all the throat is massicot yellow; the anthers are deep chrome and the stigmata are capucine yellow.

5. *C. speciosus* flowered from Oct. 9th until Oct. 20th at a height of 6 inches; only three corms flowered giving three blossoms from each. This species was fully described last year. The only additional note is that its poor showing was probably due to the corms spending all their energy in multiplying for the clump in the garden did much better.

6. *C. pulchellus* flowered over a long period, Oct. 10th to Nov. 12th, with a total of 15 blossoms from the six corms. But a small group in the garden flowered much better both in the number of bloom and in that they blossomed more in unison, Oct. 14th to Oct. 30th. A full description was given last year.

7. *C. speciosus globosus* flowered from Oct. 11th until Oct. 30th at a height of $6\frac{1}{2}$ inches and gave 14 blossoms from five corms. A very delightful form; it was fully described last year. But I again wish to say that in shape it is only very slightly more globular than the type and that it is the darkest in color of the several *speciosus* forms.

8. *C. speciosus Aitchisonii*. I must correct what I said last year about it

not being noticeably different from the species for two corms this year showed me what it was really like; the others are merely the type which explains why I could see no difference last year. These two corms flowered from Oct. 12th until Oct. 28th at a height of $7\frac{1}{4}$ inches and produced seven blossoms. In color the outer segments on the exterior are silvery bluish lavender with veins of light dull bluish violet, while their inner sides are dull bluish violet (3) with veins of soft bluish violet; the exterior of the three inner segments is bluish lavender with veins of soft blue-violet, the interior is light hyssop violet with veins of soft bluish violet. The throat is pinard yellow; the anthers are empire yellow and the stigmata are mikado orange. The veins are not nearly so pronounced as in the type and the flower is darker, but not so dark as the variety *globosus*. I still wonder about this for Bowles distinctly says the flower is lighter than the type.

9. *C. karduchorum* flowered from Oct. 17th until Nov. 10th at a height of $4\frac{1}{2}$ inches and gave 31 blossoms from the six corms. The full description was given last year and only this need be added, at the height of its bloom there were 19 flowers open at once and it made a most exquisite mass of color in the garden. I can not understand why it has not been offered for sale in this country for it seems to be quite hardy and is certainly one of the best bloomers. Of course the future may tell another story. Bowles says that with him it has a fault of sending its flowering shoot out parallel to the surface instead of straight upward and "unless the soil was removed and the shoot and corm tilted upwards, it failed to reach the light and flowers and leaves rotted off underground." In the two years that I have had this species I have failed to notice any evidence

of such tendencies although I looked for a tilting of the corms at harvest time every one was upright as it should be. I am sure I have the right plant for in all other points it agrees with his description; so I hope that American climate and conditions remind it of its home in Kurdistan and it will continue to act naturally and become another jewel for the autumnal garden.

10. *C. nudiflorus* gave only two flowers this year, lasting from Oct. 23 until Nov. 4th. But I did not expect much from this species in its second year for former experience with it has been that it needed to become established before blooming well. It forms its increase at the ends of stolons sent out from the base of the corm and should be planted where there is no danger of its being disturbed and it can wander about at will.

11. *C. Tournefortii* flowered from Oct. 25th until Nov. 10th but gave only four blossoms.

12. *C. niveus* bloomed for the first time this year. The six corms produced four blossoms which were 3 inches in height and lasted from Oct. 26th until Nov. 7th; but a week later three more buds appeared and were ruined by a wet snow before they could open. It is a lovely pure white flower with a throat of deep chrome, lemon chrome anthers and scarlet-red stigmata. It is a large flower for its height and would make a splendid showing in the garden if it could be protected from early snows.

13. *C. longiflorus* var. *melitensis* produced only eight flowers this year, blooming from Oct. 27th to Nov. 10th. This was a great disappointment for the lush foliage which shows above the ground before the buds appear seemed to me to promise a heavy bloom. The type did not flower at all. However, both have yielded a heavy increase which at least indicates that they are healthy and are beginning to feel at

home. I am sure that these two will demand a warm, snug, well protected corner where they can receive every moment of sunshine in order to do their best and they are well worth all extra care spent in making them happy.

14. *C. Salzmannii* var. *erectophyllus* flowered from Oct. 28th until Nov. 11th giving eleven blossoms from four corms. This too needs protection for its thin textured flowers are easily wrecked by wind and rain. The type did not flower at all which was a great surprise to me for in the garden where it was planted years ago it has never missed a season.

15. *C. ochroleucus* showed seven buds on Nov. 24th just before a snow fall covered them. Its thin frail flowers cannot stand up under any rough weather and when the snow melted they were just a mass of pulp. A clump in the garden sometimes gives scattered bloom up until Christmas but it has the protection of an evergreen.

I was surprised that *C. medius* did not flower for twice I have had it in years past and it has always bloomed well the second year and then disappeared. Perhaps its not blooming may give it a longer lease on life this time for it made nice healthy foliage and a good increase.

Notes on Spring-Flowering Crocus Species

B. Y. MORRISON

THE first sentence in Mr. Bowles' delightful book "Handbook of Crocus and Colchicum" reads:

"The genus Crocus deserves more attention than it has hitherto received in British gardens."

Any lover of crocus may be too prone to fall back on Mr. Bowles and repeat his dicta on many diverse matters. Certainly he might well quote this particular sentence substituting the word American for British. Most people know what crocus are but few have any great number in their gardens. There was a time when they were planted in lawns in great sheets of color when well done, in polka-dots when poorly done. Here they failed if the lawns were cut too early or thrvoe if the gardener was more casual. The writer suspects that the crocus will survive longest in those gardens where there is least disturbance in the garden, least cultivation, least transplanting, least renovating!

In experimenting himself, the writer admits that usually the first planting was done with some real care as to choice of site, exposure and soil fertility giving not too much competition, a southerly exposure and a loose rich soil that needs no added drainage. In nearly every case the crocus have settled down like natives but only in two cases, *Crocus Tomasinianus* and *C. imperati*, have they become so much at home as to produce seedlings as freely as our favorite chickweed.

These pages can not hope to record a complete inventory of all crocus species, or even of those that are available with diligent search. It records only a group of spring-flowering species and forms that were grown here, some after many repetitions.

Crocus are small cormous plants native chiefly to the lands lying north and east of the Mediterranean. Among them are species that start flowering in early autumn with others that follow

in order through the winter and spring. The varieties and species tested here belong only to the spring section, beginning in mid-February and flowering in series till early May. As might easily be guessed, the weather of the particular season determines whether or not the plants come to successful flowering, for no matter how hardy the plant may be its developing flowers are no match for real freezing or snow and sleet.

After having known only the named garden forms of Dutch crocus (*C. vernus*), some of the species and their forms may seem a little small, but since they flower early they will be welcome no matter how much more slender their flowers.

Of the crocus planted last autumn, the first to flower was the form of *Crocus chrysanthus* known as Snow Bunting with ivory-white flowers flushed at the base with buff yellow both inside and out with a few dark brown veins on the tube. This pale color is accented by the orange stigmata. It has a pleasant scent, something like the odor of a good garden pansy. Its sister form, Canary Bird, followed it quickly with deep orange flowers marked and stained with reddish brown on the outside. *Crocus biflorus argenteus* came next with rather starry lavender flowers, followed quickly by the type, *C. biflorus*, deeper in color and less starry in form.

After these there were so many in flower that an absolute succession is almost impossible to give. Instead it will be more simple to give fuller descriptions of each form with the weekly readings for each group.

Crocus imperati (Feb. 5) if this gardener were to be allowed but one spring crocus species, it would be this. The flowers come with almost as much regularity as the winter snowdrops during any mild winter weather. The first

flowers race ahead of the leaves but later the leaves make a tangled mass in which the flowers rest. These are of good size, 4 to 5 to the corm. As they push up, they look as if they might be café au lait to buff in color sometimes feathered with dark purple. When the flowers open, the inner surfaces are essentially pinkish violet from medium tones to almost red purple.

Mr. Bowles has much to say about the variations in hue and pattern of this species from the "mountainous districts around Naples" but none pique the curiosity more than his description of the var. *albiflos* of Herbert which must be more lovely than we can well imagine.

C. aureus (Feb. 22) is a vigorous species with a long garden history, and innumerable garden forms; with four to many flowers per corm depending upon the vigor and age of the planting, enough in most cases to furnish flowers for almost a month. The flowers are about four inches high, of ample size so that they are rather bowl-shaped when open in the sun. In effect they are golden yellow; according to Ridgway Cadmium Orange fading to Orange with lighter stamens and no marks or shadings. Slightly scented.

C. biflorus Weldeni (Feb. 22) from Dalmatia has very slender flowers starry on opening, a white ground flushed with lavender made by innumerable fine dots that range between Pale Mauve and Mauve. It is distinguished by being more robust than the type. Bowles reports many color forms.

C. stellaris (Feb. 22) at first glance seems a pale *susianus* with orange buds feathered on the outside with Madder and Hessian Brown, the inside Cadmium Orange. It is a less leafy plant than *C. susianus* and less brown stained. There are 2 to 4 flowers per corm developing successively. There is very little scent. According to Mr.

Bowles, writing in 1924, it is fairly rare in cultivation but this seems scarcely so.

C. biflorus (Feb. 22) is not yet open but all the buds are well developed and curious in that the cadmium orange stigmata protrude.

C. alatavicus (Feb. 22) from "the Ala Tau Mountains and neighboring tracts of country in Eastern Turkestan" is not open but its slender buds are well formed and show the curious color. The outer segments are a faint Cartridge Buff almost completely covered with a fine sanding of Cinnamon Drab that passes to Dark Purple at the base of the tube. When open the inner surfaces prove to be grayish white warmed by the color of the backs of the petals. The stamens are light cadmium yellow.

C. chrysanthus Canary Bird (Feb. 22) already opening on Feb. 19, and already noted is Orange paling to Cadmium Yellow. The washes and veins on the outer surface lie between Cinnamon Brown and Prout's Brown. The zone of intense brown at the base of the segments above the tube shows through on the inside as might be expected. Stamens and stigma are cadmium yellow. Flowers 3-3½ inches high, 10 to 12 to the corm, but only faintly scented.

C. chrysanthus Snow Bunting (Feb. 22) is a creamy or ivory white, purer on the inner three segments. The bowl is a little warmer than yellow ochre, the stamens cadmium yellow; stigma cadmium orange. The shadings on the reverse are Echru Olive veined with Deep Violet Gray. The flowers are 3 to 3½ inches high, 8 to 12 per corm and are sweetly scented.

C. Fleischeri (Feb. 22) from "Asia Minor near Smyrna and in the Cilician Taurus," as grown here is the least showy of the species for, while the

starry flowers are pure white with a curious pinkish cast from the shadings at the base of the segments and the much divided, Orange Chrome stigmata, the flowers are so small and so irregularly starry that they make no great show. They rarely exceeded 4 to the corm or more than 3 inches in height.

C. biflorus argenteus (Feb. 22) has scented flowers as starry as those of the last but of sufficiently larger size to make them more impressive. They average 4 to 7 per corm and 4 inches high. When widely open the inner surfaces look pale lavender (Pale Bluish Lavender), the three outer segments darker because of the feathered stains of Light Hyssop Violet. These parallel the markings of Deep Slate Violet on the backs which show clearly on the ground of Creamy Buff or Cartridge Buff. The bowl at the base of the perianth segments is Yellow Ochre, the stamens Cadmium Yellow, the stigma Cadmium Orange.

C. etruscus (Mar. 5). If it were not for its conspicuously larger size, this species from the "west coast of Italy" might be mistaken for *C. Sieberi* since it is about the same color as that species with the same tendency of darkening on the edges of the petals. It stands about 4 inches high with somewhat starry flowers that have rounded perianth segments rather than pointed. The Ridgway colors show Pale Verbena Violet through Lavender to Light Lobelia Violet, all colors on the pink side of lavender. The anthers are Lemon Chrome and the stigmas Cadmium Orange, just the brilliant hues needed to set off the clear lavenders.

The Zwannenberg selection from the type is apparently a selection of a slightly deeper color form.

Neither type nor variety is scented. Each has a few feathered markings on the outside of the petals. Each gives 2

to 4 flowers per corm, 4 to 5 inches tall.

C. Sieberi (Mar. 5). This is one of the most common and most prolific of spring species with fragile-looking flowers white at the tube, the segments Pale Mauve washed with Pale Lavender Violet. There is an orange zone at the base of the petals of exactly the same hue as the anthers but paler than the Orange Cadmium stigmata. The flowers, which are faintly scented, are rarely over 4 inches high. They open very flat on sunny days and look best here in open grassy woods where the grassy floor is fairly open and does not resemble a lawn!

C. Tomasinianus (Mar. 5). This species from "parts of Dalmatia, Bosnia and Servia" is almost as common as the last species and is even more permanent and spreading when once established. Like the last it is much less frail than it appears. Rather dull in bud, it opens to a warm variable lavender.

C. Tomasinianus Barr's Purple (Mar. 5). This is by no means as purple as the form that follows although it is much deeper than any of the variants of the type that have flowered here.

Although Mr. Bowles suggests that this species has a wide range of color forms "from pure white to a glowing amethyst purple that in some seedlings approaches nearer to crimson than I have seen in any other Crocus" and although it has seeded freely here, there seems to have been little variation among such seedlings that have come to flowering.

C. Tomasinianus Whitewell Purple (Mar. 5). This showy dark form produces 3 to 4 flowers per corm, none over 4 inches high, that are conspicuous among all their paler contemporaries. Essentially starry or wheel-like when open, the Light Mauve centers

deepen to Matthews Purple or even Petunia Violet, contrasting well with the pale (Antimony) yellow stamens and Cadmium Orange stigmata.

C. biflorus Weldeni (Mar. 5). This vigorous form of *biflorus* continues to flower freely with very starry flowers of pure white washed with Lobelia Violet (a pinkish violet) on the backs of the outer three segments in a more or less stippled or granular fashion. The stamens are Empire Yellow, the stigmas Cadmium Orange becoming paler with age. The white form *albus* is the most charming of the white species here.

C. Balansae (Mar. 5). This species from "western Asia Minor near Smyrna" is one of the smallest of the crocus with flowers scarcely two inches high, but for all that make a particularly fine show because of the intensity of their color. The essential ground color is orange, lying between Cadmium Yellow and Light Cadmium. The backs of the outer segments are almost obscured by the sandings and stripes of warm red brown (Van Dyke Brown to Burnt Umber). The stamens and stigmas are the same color as the inner surfaces of the petals. Sweetly scented.

The Zwannenberg form of this species is practically the same as the type except that the ground color is Cadmium Orange and the feathering looks brighter because of this and the further fact that the feathers are confluent at the base. There are 3 to 4 flowers per corm, none ever more than 3 inches tall.

C. chrysanthus E. P. Bowles (Mar. 5). Although the other clones of this crocus have been in flower for nearly two weeks, this form flowers late with fine pale yellow flowers (Empire Yellow or Apricot Yellow on margins) with stamens of Light Cadmium and stigmas of Cadmium Orange. The

outer three perianth segments have an arrow-shaped mark of Orange Citrine becoming paler toward the tube. Unlike its fellows this form has almost no scent.

C. vernus albus (Mar. 7). This is rather the poorest of the group in some ways for although the flowers are pure white they are so frail and smallish that they look feeble rather than choice and delicate.

C. vernus picturatus (Mar. 7). Is enormously robust and might as well be a striped garden crocus as a clone of the wildlings.

C. aureus sulphureus concolor (Mar. 10). As far as this garden goes this is a poor crocus, feeble as compared with the type, much later to bloom and with only a mildly interesting pale sulphur color.

C. biflorus pusillus (Mar. 10). Flowered very indifferently as though the roots were not supporting the plant.

C. minimus (Mar. 20). This very

small species delays so long after leaf growth to show any sign of flowering that one gives it up as failing to bloom. The flowers themselves are almost like small editions of *C. imperati* with rather deeper red purple inside and a less definite buff exterior. In this climate, it flowers so late, when so many other things are in flower, that its charms are likely to be overlooked. Mr. Bowles speaks of it as an "octavo edition, the diphyllous forms of *C. Imperati* representing the folio, and *C. Cambessedesii* a duodecimo."

How long all these species and forms may continue to seem at home remains to be seen. Those species that have been here longest give every evidence of permanence despite the depredations of rabbits which seem to make a point of eating off the developing leaves. Heat, light and drainage appear to be to their liking, but no matter what degree of permanence they may show, they are worth repetition for the sake of their early brilliance.

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Claude Hope

Crocus alatavicus



Claude Hope

Crocus aureus.

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Claude Hope

Crocus aureus sulphureus concolor.



Claude Hope

Crocus balansae

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Claude Hope

Crocus balansae Zwannenberg



Claude Hope

Crocus biflorus.

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Crocus biflorus argenteus.



Claude Hope

Crocus biflorus pusillus

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Crocus biflorus Weldenii



Claude Hope

Crocus biflorus W'cldeni albus

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Crocus chrysanthus, Canary Bird.



Claude Hope

Crocus chrysanthus, E. P. Bowles.

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Crocus chrysanthus, Snow Bird.



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Crocus etruscus.

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Crocus etruscus Zwannenberg



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Crocus Fleischeri

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Crocus imperati



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Crocus Sieberi

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Crocus Stellaris



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Crocus Tomasinianus

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Claude Hope

Crocus Tomasinianus, Barr's Purple



Claude Hope

Crocus Tomasinianus, Whitewell Purple

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Claude Hope

Crocus versicolor picturatus

Rhododendron Notes

CLEMENT GRAY BOWERS, *Chairman*

Rhododendrons in New Hampshire

This is definitely not a region where almost any kind of a Rhododendron may be grown, yet I think that all of the hardy American species will do well here, and a fair number of the foreign species and the hybrids. I might, perhaps, know more about their behavior if some creature, probably a mouse, had not eaten all the tops of several flats of seedlings of various species, and I have not found time to repeat the experiment.

Four species are native here, besides *R. lapponicum*, which occupies northern mountain summits in other parts of the world as well, and in other ericaceous plants we are fairly rich. Unlike the poor relations of some other families, not one of these that I know, but has some beauty and charm of its own, though most of them are not suited for ordinary gardens.

If we walk in the woods, with an ovenbird calling insistently, "Teacher! Teacher! Teacher!" and at a distance a thrush singing the most heavenly of bird songs, we are fairly sure to see some small plants that belong to the family. Here are the shining evergreen leaves of Pipsissewa and Spotted Wintergreen, (*Chimaphila umbellata* and *maculata*), and the short spikes of sweet-scented flowers of some of the Pyrolas. Who doesn't like to nibble the tender young leaves and red berries of the Checkerberry (*Gaultheria procumbens*)? If we are fortunate, we may find the dainty sprays of the Creeping Snowberry (*Chiogenes serpyllifolia*). Indian Pipe (*Monotropa uniflora*) is

fairly common, mostly in the deeper pine or oak woods, and False Beechdrops (*M. Hypopitys*) is also found, though not so often.

As in many other localities, May-flowers (*Epigaea repens*), though still fairly plentiful, are not so common as they once were, people having loved them "not wisely, but too well." If that may be called love which destroys its object!

The rhododendrons seem to prefer the meadows and the banks of the brooks and little rivers, growing in both sun and shade. When I first knew rhodora in Massachusetts, the location must have been too shady, for the long straggly growths and thin clusters of frail flowers were far from deserving Emerson's encomium. But here in our sunny meadows, the plants are much more compact and floriferous, and add a welcome note to the spring landscape, though the color is not too pleasing near at hand. *R. nudiflorum*, the Pinxter-Flower, blooms a little later, about Memorial Day. It is known here as June Pink, or Election Pink, the latter name usually being pronounced without the initial E. *R. viscosum*, the White Swamp Honeysuckle, comes later, and is much less common in this vicinity. *R. maximum* grows near Monadnock, and may still be found, I am told, in one or two other places not far away.

Still another denizen of the meadows is the Cranberry, which one would hardly suppose, from the taste of the berries, to be closely related to the Blueberry, yet it is *Vaccinium macro-*

carpon. One may pick his own accompaniment to his Thanksgiving dinner, if he likes, in many a meadow.

The Kalmias are very common here, the Sheep's Laurel, Lambkill, Wicky, to give *K. angustifolia* a few of its names, growing everywhere near the meadows and in the pastures. *K. glauca*, the Pale Laurel, is not so omnipresent, but the Mountain Laurel (*K. latifolia*), in much of our region, is the glory of the pastures and open woods, as it is farther south. Here it is in its prime about the last week in June.

The Bearberry, (*Arctostaphylos Uva-ursi*), is unlike most of its relatives in preferring a rather hot dry situation in which to trail its spreading branches. It seems to be perfectly at home on the sunny side of a railroad cutting, or on a gravelly roadside.

The Sweet Pepper-bush (*Clethra alnifolia*) may be grown inland, but is found naturally nearer the coast, where it is plentiful.

It is the Blueberries and Huckleberries (*Vaccinium* and *Gaylussacia*), however, that would take first place in numbers in most of this region, and in value, the lovers of blueberry pies and cakes and puddings would declare with one voice. From a practical standpoint, anyone must agree, for the blueberry-picking is a fair size industry, but Blueberries rank high from an aesthetic point of view, also, I doubt if many people realize how much of the fall color that lies like a gorgeous Persian carpet over our hills and pastures is provided by the Blueberries. They are of all sizes, from the dwarf early *Vaccinium pensylvanicum*, which grows in open pastures, to the tall late *V. corymbosum*, which sometimes grows with its feet in the water for a considerable time.

I have never climbed the high mountains, but there are several there,—*Vaccinium Vitis-Idaea*, *Arctostaphylos*

alpina, *Cassiope hypnoides*, *Bryanthus taxifolius*, *Loiseleuria procumbens*, and *Rhododendron lapponicum*, as aforesaid.

I have still to make the acquaintance of *Cassandra calyculata* and *Ledum latifolium*, also.

Our city parks are making more use of the rhododendrons and azaleas as time goes on, one superintendent saying that he finds *R. poukhanense* and *R. calendulaceum* particularly useful. *R. mucronulatum* does very well here, also *R. kaempferi* and *japonicum*, and *R. carolinianum* is perfection.

The evergreen rhododendrons are of little value here for the winter effect of their foliage, as the leaves look very unhappy too much of the time. One of our good horticultural writers stated that *R. carolinianum* did not curl its leaves in the cold, but that is an error, for I have often seen it with its leaves curled until they were smaller than my little finger. Mountain Laurel and *Pieris floribunda* are not so shivery, and the small evergreen plants in the woods are charming at all times, though the snow hides them from our sight for weeks at a time.

I have not been able to discover whether anyone near here has experimented with the dwarf alpine Rhododendrons.

In this family and in this climate are plants that bloom from early spring to midsummer, and fruits that carry on for the rest of the year, for Checkerberries last until nearly, if not quite, time for the plants to bloom again. There are evergreen plants large and small, and deciduous shrubs whose leaves turn all sorts of lovely colors in the fall.

If we may not go exploring for plants in foreign countries, we have an excellent substitute in the exploration of our own countryside. We may not be able to find any plants that are new to the botanists, but we shall certainly

find some that are new to ourselves, and we may be able in some small way to add to the sum of human knowledge. And the pursuit of this one family will take us into cool woods and sunny meadows, beside clear brooks and up high mountains. What greater pleasure could we ask?

RACHEL CAUGHEY.

Notes on Hybrid Azaleas.

The strain of azaleas known as Arnoldiana, reported as hybrid between *amoena* and *Kaempferi*, is apparently midseason in its flowering, coming curiously after both the parents are in full flower and after the main mass of Kurume varieties are in full bloom.

Only six named forms have been grown here all opening about the same time except Briarcliff. If there is any difference in opening among the others, it may be as follows: Mosseana, Mello Glow, Early Dawn, Dexter's Pink, Cardinalis.

The color range is not wide. As is the case in many hybrids, there is a general color effect as seen in landscape mass and a rather different color if one attempts to use a color chart. Mosseana and Mello Glow carry as purplish rose; Dexter's Pink and Cardinalis as rose red; Early Dawn as light rose color chiefly because the color lightens appreciably to the edges of the petals. Briarcliff is rose pink.

In habit, the plants appear to be much more spreading than one expects of *Kaempferi* hybrids which often are tall and thin until fairly old, when they commence to thicken up with the production of flowering twigs and branches. Of this set Cardinalis is the variety that runs up most quickly.

The flowers sizes do not vary much, all being larger than *amoena* and smaller than *Kaempferi*. In shape they resemble the latter parent.

The plants are deciduous in about the same degree as *Kaempferi* which holds many of its leaves late into mild winters but is never evergreen here.

If one lives in climates of great severity, these might be useful plants, but wherever Kurumes or other similar clones or hybrids can be grown safely, they are scarcely needed.

The azaleas that are known as *Kaempferi* hybrids are reported as hybrids between *Kaempferi* and *malvatica*. The writer has been unable to find much data on the latter plant. Among the specimens seen, some resemble the Kurume azaleas, but in hundreds of seedlings raised between *Kaempferi* and various Kurume azaleas no seedlings have appeared that resemble this strain. Among the varieties offered there seem to be at least three group types; one set, the largest flowered, with clones that suggest enlarged *Kaempferi*, one that suggests the influence of the azaleas long known in trade as *macrantha*, and one that suggests the influence of the azalea known in trade as *indica alba*.

Although *Kaempferi* itself is by no means uniform in its flowering with some clones flowering after the earliest forms are past their peak, all of these hybrids are fairly uniform in opening and much later than the main masses of *Kaempferi*.

As grown here, the smallest flower is Othello which is a brilliant red (Rose Doreé of Ridgway flushed with Scarlet Red). It is as dominant a color in the garden as is the color of the too widely planted Hinodegiri. Why it has not become as commonplace is a mystery.

The three essentially purplish varieties, from light to dark, are Carmen, Atalanta and Purple King. They are clear rosy-lilac colors made brilliant by the warmer, less purple, almost reddish color at the throat or tube.

Of those grown here, the varieties that approximate *Kaempferi* are Thais, Mary, Louise, Lakme, Fedora and Betty. If one only were to be chosen, it would be Mary which is essentially rose pink (between Deep Rose and Deep Rose Pink of Ridgway with a flush of Thulite Pink, which is faintly salmon in hue). If a second were to be chosen, it would be Thais, which is also rose color but enlivened by a flush of yellowish red (Eugenia Red) on the base of the tube. Louise is almost identical with Mary but the flowers are smaller, the plants more dwarf and more twiggy. Lakme is the paler edition of Mary and Betty a deeper counterpart. Neither is as large.

There are other named clones in this series but none have grown enough to show their correct characters. There are also innumerable unnamed "mixed" seedlings of this strain. All are excellent. If they can be purchased when in flower, one can get exactly the hues he wishes.

All the varieties seen respond to conditions that suit *Kaempferi*, the most essential being a certain degree of shade during flowering to prevent the fading (scorching) of the flowers from too much sun. Apparently all will approximate *Kaempferi* in size and age.

Rhododendrons in Seattle

The Arboretum of the University of Washington at Seattle is developing a collection of Rhododendrons which promises to be the most extensive in the United States and larger than any other in the world outside of southern England. This is possible because of mild climatic conditions without extreme heat or cold, a high percentage of humidity, a naturally acid soil, and a diversified topography which combine to give the Puget Sound area an almost ideal situation for their growth. They

will probably be featured more extensively than any other group of plants in the Arboretum. The two areas set aside for them (Rhododendron Glen and Azalea Way) will do much to enhance their natural loveliness.

Rhododendron Glen, where the species will be planted, is a large ravine of about eleven acres, through which runs a small stream with varying conditions of moisture, exposure and sun. The head of the Glen is narrow, rocky and deeply shaded, but gradually opens out into a wide amphitheatre formed by high hills on either side.

Along this stream and in the rocky area Alpine Rhododendrons and other low growing species will be placed; while the shrub forms will grow on the gently sloping hillsides with the larger tree species still higher against the jagged outline of native conifers.

For this first planting the English Rhododendron Association Year Book is being used as a guide, first in selecting species of accepted garden merit, and second in securing those of known hardiness. This group includes about two hundred and forty-seven species with English ratings of from one to four stars for merit, and from A to D for hardiness.

These English ratings are defined as follows:

- A—Hardy anywhere in the British Isles and may be planted in full exposure if desired.
- B—Hardy anywhere in the British Isles, but requires some shade to obtain the best results.
- C—Hardy along the seaboard and in warm gardens inland.
- D—Hardy in the south and west, but requires shelter even in warm gardens inland.

In following this procedure we are assured of getting the best of those species that have been grown in the British Isles and of eliminating heavy

losses due to lack of hardiness. These ratings have been tested by many Puget Sound growers, and we feel perfectly safe in proceeding on such a basis, as our climatic conditions are very similar to those of England and many growers are successful with varieties even more tender than the ones selected. Already more than one hundred different species of this group are now in the Arboretum nursery with another large shipment of species due from England this Fall. Then there are a number of other varieties which are being grown by private individuals which will augment this collection.

Our second planting will be from a group of between three hundred and four hundred species which do not receive merit ratings in England or are considered more tender than our first group.

This is to be chiefly a test planting to determine:

A—The value of those which have already blossomed in England, but are not considered worthy of merit ratings. (These may vary considerably when grown under changed conditions.)

B—The merit of those which have not as yet blossomed in England.

C—To test the hardiness of the more tender varieties under different ecological conditions.

A third development in species will be the propagation of new seeds from various expeditions such as those recently gathered by Mr. T. T. Yu of the Yunnan Expedition of Fan Memorial Institute of Biology of Peiping.

All the planting in Rhododendron Glen will be naturalistic, but along Azalea Way there will be a different situation requiring different material and different handling. This is a wide avenue about three-fourths of a mile in length and will be planted to a depth varying from fifty to one hundred feet

on either side, and will be massed with the finest specie and hybrid Azaleas and hybrid Rhododendrons. This area will give us about a mile and one-half of bloom and promises to be an outstanding display.

First, there will be the better Azalea species and the finest American hybrids, next, fifty deciduous varieties of the finer English and Dutch hybrids including Ghent, Rustica Flore Pleno, Mollis and Occidentale crosses.

In the evergreen division the best of the Kurumes, Malvaticum X Kaemferi, and all the new crosses of Eriocarpum, Indicum (Macranthum), Scabrum and others. In this group are twenty-one varieties which receive merit rating in the Rhododendron Year Book, but in addition there will be included many new Japanese importations now being grown in the Pacific Northwest and which will undoubtedly gain merit awards when more generally grown.

In the hybrid Rhododendron planting which adjoins Azalea Way we will include only the finest of the English and Dutch creations which are such a marked improvement over the older varieties which were developed from the Ponticum and Catawbiense crosses. Here such lovely things as R. Loderi, var. King George, with its seven-inch white bells and enormous trusses, clear velvety textured reds such as the Earl of Athone and Helen Fox will vie with a hundred others through the entire range of colors.

Considering the group as a whole the outstanding feature of this collection will be the flowering sequence. This will start in January or early February with *R. mucronulatum* followed by *R. moupinense* and other early bloomers. By March 1st the large flowering broadleaf varieties begin their display with such hybrids as *R. Rosa Mundi*, *R. Nobleanum Venustum*,

R. Helen Fox, as well as dwarf varieties such as *R. racemosum* and *R. oleifolium*.

April ushers in a new crop of blossoms from both species and hybrids, increasing in number each week until mid-May, when we reach the height of the flowering season. From then on the numbers decrease, but not the beauty, for such lovely things as *R. Britannia*, *R. Pygmalion*, and *R. Griersonianum* continue a blaze of color into June, while Japanese Azaleas carry us into July. Even this is not all, for August brings *R. auriculatum*, with its lovely white trusses and September has *R. Serotinum*, which is not particularly attractive in form but desirable coming at that period of the year.

It has been necessary to import most of the Arboretum plants or grow them from seed, so many have not blossomed as yet, and today one must visit private gardens where they are grown to see the range of beauty en-

compassed in this group. But this condition is rapidly changing, and with the new acquisitions, this year will see a large number of blossoms which will be greatly increased with each succeeding year.

The Rhododendron Association has very courteously inserted in the 1939 Year Book the blossoming time of all species as far as known, and we expect to supplement this by our own experience with hybrids so that complete information will be available not only to the amateur, but to the hybridist as well. Such information will be particularly valuable to our colder regions, as there are many species which are perfectly hardy in growth, but flower too early to escape the late spring frosts.

It is the hope of the Arboretum Rhododendron Committee that we can develop a surplus of both species and hybrids of the better varieties for exchange or loan where experimental work is done.—HERBERT IHRIG.

A Book or Two

Common Sense in the Rock Garden.

James H. Bissland. A. T. De La Mare Company, New York. 1938. 217 pages, illustrated. \$2.50.

This compact little volume is the best American book, I believe, which has been written on rock gardens for the beginner. Basic principles are explained and illustrated in a simple and comprehensive manner without being infantile in the manner of numerous elementary gardening books. It is not a book for the rock garden specialist or the grower of more difficult alpine plants and makes no mention of scree, moraines and the like. Especially

helpful are the suggestions for making the rock garden naturally a part of the landscape plan, and likewise the simple illustrations and drawings of type, placement and use of rocks are most practical. Proper emphasis is laid upon the selection, placement and cultural conditions of various plants, although the latter are sometimes too sketchy. The lists of plants and shrubs are by no means limited to run-of-mine subjects but no plants requiring special or unusual conditions are mentioned. Within its limitations as a book for the ordinary gardener or the beginner, it is extremely helpful and practical and

should accomplish much in causing the disappearance of the many rock piles called rock gardens and dissipate many false conceptions in respect to rock gardens and their use.

R. C. M.

Wild Flowers of Australia. Thistle V. Harris. Angus and Robertson, Ltd., Sydney and London. 198 pages illustrated in color.

It is difficult to be sure, but this is apparently a popular book that is sufficiently well planned to be useful to more advanced amateurs and botanists than its title might suggest. The book is in two parts, the first 67 pages being paragraph descriptions to accompany the 248 species illustrated in color. The remainder of the book is given over to keys, a glossary, an index and other useful data.

The illustrations are charming and well reproduced, the texts are vividly written, but are necessarily incomplete, the greatest lack being any suggestion as to the amount of reduction given each subject in the reproduction of the painting.

In this country it would be used as a flora from which gardeners might choose subjects to be introduced from Australia, if seeds could be found.

The World of Plant Life. C. J. Hylander. The Macmillan Company, New York, 1939, 722 pages, illustrated. \$7.50.

This book is written for the layman with the hope that it will increase his interest in the great world of plant life about him, the world that ranges from the lowest and least visible forms to the most complicated. It is written also in a form to suggest the possible or probable line of development with the necessary suggestions as to what plants remain now representing types

that were much more abundant in centuries gone by.

There are no keys, for the book is not intended to be used in plant identification. There are, however, general treatments of families, so that one may eventually learn to know to which family a plant may belong by the general aspect.

The vocabulary is simple. Common names are used freely. There are many illustrations and innumerable diagrams.

The gardener who grows plants only for cutting or for effect may not be interested, but the gardener whose garden is an unending delight from his knowledge of plants that compose it, of the beauties of their structure and parts, of the wonder of their being, will want this book at his side, until its contents are part and parcel of his store.

Garden Planning and Building. H. Stuart Ortloft and Henry B. Raymore. Whittlesey House, McGraw-Hill Book Co., Inc., New York, 1939. 244 pages, illustrated. \$3.00.

The authors recognize the fact that this is another book on a topic already treated by others. They hope, however, that their book may find a place for those persons who still find some difficulty in using the existing books. Whether or not this can be, remains to be proven by the readers.

Like all the books by these authors, who have collaborated before this, the text is clear and direct and the developments of their several theses simple and convincing. The general tendency of their taste seems more or less marked and is not altogether catholic, if one may guess from various somewhat dogmatic assertions, but since this is a book that has to do with principles rather than with taste, this is not vital.

SAXIFLORA. The American Rock Garden Society, New York, 1938. T. H. Everett, Chairman, the Editorial Committee. Illustrated. \$0.10 per fascicle.

This new publication of the American Rock Garden Society is published at intervals by the editorial committee. The first group appeared in December, 1938, consisting of eight four page separates punched for loose leaf binding. Each fascicle consists of a title page, a full page illustration and the balance in text.

The subjects of the first group are: *Daboezia cantabrica*, *Chrysogonium virginianum*, *Epimedium macranthum*, *Alyssum scardicum*, *Saxifraga cortusifolia*, *Daphne Genkwa*, *Primula vulgaris*, *Scilla sinesis*, with texts written by all the members of the committee save Mr. English. With the exception of the alyssum, drawn by Miss Maud H. Purdy, all the illustrations were drawn by Miss Margaret Sorensen. Each records a habit sketch, a detail of the inflorescence and various en-

larged details after the plan familiar from generations of plant texts. The drawings themselves are quite charming.

The texts vary somewhat according to the style of each writer but in plan, they give first a rather popular discussion of the plant, its history, occurrence and culture, followed by a somewhat more technical description with references to botanical texts and synonymy.

The prefatory page announces that publication will be devoted "to plants suitable for cultivation in rock gardens in North America," a statement which should forestall purists who will recall that most of the plants in this group are not strictly saxatile in nature.

No recommendations are made as to what parts of the United States are best suited to each subject, but the intelligent gardener who reads the note on habitat should be able to do his own translation and decide for himself whether his particular site is favorable or whether he is able to make the necessary adjustments.

Rock Garden Notes

ROBERT MONCURE, *Editor*

PrimulaeJuliae and Hybrids.

The Polyanthus group of primroses are generally satisfactory in the more northern sections, or where soils are deep and adequately moisture supplied. But on other soils, or in sections with longer, hotter summers, or even on favored soils, if not regularly divided and reset, the finest colonies are sure to suffer either lack of vitality, or even to succumb entirely to summer heat or winter's cold.

Therefore, when the first *PrimulaJuliae* came to me from an Illinois gar-

den, where it was reported as having done particularly well, it seemed to offer a hope that this family would withstand adverse conditions. This has proved true so far, and so long as the typical root habit of *P. Juliae* is found in its hybrids, it may be hoped that it will transmit that ability. Just how much this root may have to do with the ability to withstand heat is difficult to say, but it is more than sure that typical *P. Juliae* forms, whether simple variations or hybrids, do not stop growth so entirely during the summer months,

even on very dry ground and in full sun. And as the root is somewhat rhizomatous, it may be that it serves as a reservoir of moisture to help the plant over the difficult season.

Introduced about 1910, *P. Julianae* greatly resembles in leaf structure and flowering habit plants of the Polyanthus group. The flower stems of the species are short, and while the flowers are fair sized, they are so closely held in the erect foliage as to lose much of their value. And worst of all, they are of a particularly villainous shade of red, which is a very fixed characteristic in all seedlings. The first breaks in the strain were a tendency to longer flower stems, which held the cluster above the foliage and increased the resemblance to the Polyanthus. And with hybridization have come other colors, though not as yet to the extent they are available among the Polyanthus.

Because of the aversion professed by many people to the particular red which is the most common color phase of this primrose, it is hard to expect a large popularity for it. On the other hand, a bed of Primrose Lodge, one of the first forms to really show the flowers nicely, is a particularly cheery sight in spring, contrasted with the various yellows that are so common then. It is noticeable that nursery visitors are attracted to it when seen under those conditions, while later in the summer the same persons profess to find similar colors distasteful. From this red come the blue shades, such as Wanda and Helen Muller, which do not really become blue until the flower begins to fade. In addition there are Kinlough Beauty, with rose-pink flowers, and Icomb Variety, also rose. Mrs. McGillivray is more truly of *P. Julianae* type than any of these, and is a strong growing form, also with large old rose flowers. Then there are Pam, with

bronzy foliage and maroon-red flowers, and Crispa, with burgundy-red blooms and noticeably ruffled foliage. Last of all, we have Dorothy, a pale primrose yellow with golden eye, and Schneekissen, a pure white form.

Within a very short time, it is more than likely that we shall have even more variations of color in this group of primulas, until eventually they will become not a definite species, with its forms and hybrids, but a group of inter-related forms such as the Polyanthus truly is. There is some question in my mind at present as to how closely the newest hybrids of *P. Julianae* relate to the parent, but as the raisers do not seem to have kept records of their crosses, and varieties have been assembled from many varied and far apart sources, and as some are not being grown in sufficient quantity to permit careful comparison, it is impossible to make accurate statements. Only this is certain, wherever the blood of *P. Julianae* is apparent we find an energetic plant, capable of withstanding heat and adverse conditions, free of flowering, satisfactory in almost every way. My own observation is limited to Vermont and New England, where nearly all primulas do well, but I have satisfactory reports from the Middle West, and as far south as Virginia, to uphold me.

FRED M. ABBEY.

Vermont

Primulas in Southern Ohio

DURING the past ten years I have grown hundreds of varieties of alpines both in alpine house and outside, including many primulas, with more but mostly less success. However I have found that in the average gardens many of them would not grow at all, whereas others have been most successful and popular. The following notes relate my experiences in growing various Primulas from seed and propagation

of plants over a number of years, including the drought ridden ones:

P. Helenae—Dwarf with burgundy-red flowers and a good bloomer and grower. *P. Juliae* form.

P. elatior—Easy and permanent inhabitant.

P. hirsuta—Had this form from Austria and flowered well in alpine house for three years but stock was lost through mistake.

P. farinosa—The Bird's Eye primrose with short scapes and rosy flowers, which although easily grown from seed and flowers as small plants, dies from improper care in the average garden.

P. Becciana—Best for stream side or bog. Rosy-lilac flowers. This is good but not as effective or easy as *P. japonica* or *P. Bulleyana*. Violet purple blossom.

P. capitata Mooreana—Had this for a number of years and flowered it well but it was not a popular variety.

P. Clusiana—From the high Austrian Alps. Large flowers of glowing carmine but difficult to grow and propagate.

P. marginata—Lavender blue flowers and attractive rosette of grey toothed leaves and flowered in alpine house, but suffered the same fate as *P. hirsuta*.

P. pulverulenta—Grown from seed many times and flowered well but it is not popular. Needs abundance of moisture.

P. rosca—Robust and easy to grow at times but it is inclined to go out for no reason at all. Perhaps the required moisture induces the fungi to attack it.

P. cortusoides—A Japanese woodlander with large flowers of rose-purple which does well enough for a year or two, but for some reason color not popular here.

P. Sieboldi—Thrives but same criticism as *P. cortusoides*.

P. Vervanni—New *P. juliae*—*veris*—*acaulis* cross from Holland, which so far has about the same constitution as *P. Juliae* Wanda.

P. minima—Small alpine species with tiny rosettes of foliage and nearly stemless pink flowers, which bloomed in alpine house but afterwards perished.

P. Juliae—In many different colors in hybrids and selected forms. Even the small alpine form is successful here in gardens receiving average care. Wanda and Merton are especially good.

P. auricula—Rosettes of thick smooth and almost succulent leaves. Can usually hold it for three or four years. It grows well in alpine house but not as well in open, but are grown readily from seed.

P. denticulata cashmeriana Lilac. Grows well from seed but short lived and needs replacing often.

P. Bulleyana—One of the best but requires abundance of moisture. The deep orange form grows and often reseeds in gardens here but not so successful elsewhere.

P. japonica—In all forms and colors easy and useful, especially along streams. Practically naturalized itself along our stream.

P. polyanthus—Easy and standard everywhere.

P. acaulis—I had a form of this from a friend in Austria, "Dr. Lempert," a number of years ago, but the late drought killed it. It was a beautiful yellow form which bloomed all winter long. The blues, doubles, res, etc., grow well here. I especially like *veris* crossed on *acaulis*, Helen Maag, quite beautiful pink with yellow star center.

BELDEN C. SAUER.

The Gardener's Pocketbook

Three Gladiolus Species.

Like many other horticultural matters, the species gladioli have had their times of introduction, popularity and eclipse. Even *Gladiolus primulinus* is recognized now very largely for its hybrids rather than itself. *G. tristis*, which comes repeatedly into the public prints, is valued more for its scent and its parental possibilities than for any other reason. No one can deny that its scent, reminiscent of good clove pinks, would be a delightful addition to any flower!

Gladiolus ataltus (See page 237)

This species of gladiolus has been in and out of cultivation for many years and yet it is not often met with even in these days when more people are likely to be interested in species than ever before. Perhaps this is due to the fact that like so many other South African species it has difficulty in accepting our seasons, except in certain favored localities.

As long ago as 1801 there was a good picture of it (586) in Curtis Botanical Magazine showing the curiously shaped and carried, as well as curiously colored and patterned flowers. Our photograph shows all of these same details but does not convey the curious pinkish red color (Japan Rose) of the upper lobes, the citron green of the lower lobes. The Botanical Magazine suggests that the "flowers smell like sweet-briar." Our specimens suggested crushed pine needles.

Writing in Gartenflora (76:223-226, June, 1927) Heere gives a pleasant note for this species and gives in general translation the note that "its home is in the western coastal area. Also on

small plains between Capetown and the Hottentot-Holland Mts. * * * * Farther inland where there is less rain it occurs only on the hills where soil and moisture are to its liking. * * * * The bulb is most interesting because if one lifts a growing plant he finds three corms—on top last year's corm, next lower a corm producing this year's flowers and leaves and below it next year's corm in process of formation."

Our plants have been grown always in a cold greenhouse pit, with only enough heat at night to prevent frost. The corms are planted rather near the surface in flats roughly 10 x 20 x 5 inches, using a rich garden soil mixture. They are planted about October 1, commence to grow almost at once and come into flower in February. Like many other gladioli, the flowers keep well when cut. The foliage has died off by early May. There is a fair amount of seed produced and reasonably good increase of corms.

Gladiolus Watermeyeri (See page 239)

In general shape and style of blossom this species is not unlike *G. ataltus* already described and illustrated but the coloration, pattern and scent are quite different.

Mrs. Bolus, describing it as a new species in South African Gardening (Aug., 1927, 17:293-294), writes in part: "a flower of a new gladiolus of the Kalkoentje type sent to the National Botanic Gardens, where our plant flowered in 1917 when Miss Page made a painting. The number is missing but there is every reason to believe it was sent by Mr. E. B. Watermeyer. The same species was collected by Dr. Marlott (5589) in damp places near

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Lilian A. Guernsey

Gladiolus alatus

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Nieuwoudtville, Bokkeveld, at an altitude of 2,800 feet, in August, 1913, and it is hoped collectors will be on the lookout for it, as very little dried material exists. The upper perianth segments are pale, flushed and lined with pinkish purple and the lower are a yellowish green; anthers dark blue, reaching nearly to the tip of the perianth, and the stigma extended beyond it. Produced leaves 3-4, the lowest longest, up to 20 centimeters long, 5 millimeters broad."

To one who has not seen the plant this can not seem a very prepossessing description. The flower is essentially cream with a tint of green, flushed with dull browns that are difficult to describe without the use of drab color terms that seem unfortunately dull. The darkest marks are deep greenish purples and there is a general quality of velvet texture in the petals that gives an extra beauty. Only the bright chalcedony yellow patches on the lower lobes enliven the color.

The especial interest of the plant lies in the delightful scent, much more pleasing than that of *G. alatus* and strongly suggestive of violet.

Cultural practice here was as for *G. alatus*, with flowering in February.

Gladiolus vittatus (See page 241)

In Curtis Botanical Magazine, plate 538 (1801), there is figured *B. undulatus* var. B which is referred by Bailey (Standard Encyclopedia of Horticulture) to this species.

Although the text reads "stems from eight inches to a foot high, sometimes simple, sometimes branched," and the colored plate shows a nicely drawn and well colored specimen, neither text nor plate suggest the tall and well branched specimens as grown here where the stalks are certainly from 18 to 24 inches tall and more often branched than simple.

Whether or not the generous culture given here is responsible for the taller spikes, one can only surmise.

In any case the plant has much to recommend it for those fortunate enough to be able to grow it out of doors and to those like ourselves who must give it a cold house treatment. The flower stalks when cut continue to develop their blooms with little change in color, which is a very charming pale pink (Cameo Pink) with deep rose red (Spinel Pink) stripes. The wide branches, the well-set flowers, the undulate margins of the petals all present a most sprightly flower.

Lachenalia unicolor (See page 242)

The Cape cowslips are a small group of bulbous plants that have been in cultivation in various places and varying degrees for well over a hundred years; that have had in this time as famous a champion as the late Reverend Joseph Jacob, and yet are rarely met.

It has never been possible for the writer to see these plants growing in the open air, or to have first hand reports on their behavior as garden plants. It has been necessary always to grow them as winter-flowering bulbs in a cold greenhouse, where they make lush growth and flower toward spring.

Since we were concerned more with the increase of bulbs than any demonstration of the best appearance of the forced plant, the bulbs were grown in deepish flats rather than bulb pans, given a liberal supply of food and moisture, with the result that the leaf masses were too luxuriant, falling about as if in a meadow and carrying the flowering stalks with them, but never hiding them.

The species are somewhat confused in the literature since they are variable plants in many ways and since the original descriptions seem often to have been based on incomplete material.

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Lilian A. Guernsey

Gladiolus Watermeyeri

[See page 236]

Our plant which is probably correctly named is almost an exact duplicate of the plant that furnished the plate of *L. racemosa* (B.M. 1517), a species name no longer of good standing. It is one of the less ornamental species although masses of its creamy white flowers, sometimes tinted with lavender blue, are quite charming.

Although it cannot compete with the better clones of *L. tricolor*, it should always be a welcome addition to the cool house for midwinter or later.

Hippeastrum candidum Stapf (See page 243)

Hippeastrum breeders for years have sought a pure white hippeastrum, but their best selections still fall a little short of the mark. Those engaged in this effort must have been delighted when they read in Gardeners' Chronicle of London under date of September 24, 1938 (Vol. 104, p. 230), an account by J. M. C. Hoog of the discovery of a pure white species, *Hippeastrum candidum* Stapf in Argentina, and of its establishment in England and the Netherlands.

The writer had read of this with some envy and unsuccessful efforts were made to obtain a stock. It was a great surprise and pleasure then to identify with this species a plant that was collected in Haiti in 1931 and flowered for the first time in July of this year.

The original description of *Hippeastrum candidum* was published in Curtis's Botanical Magazine along with an excellent color plate as t. 9184 in Vol. 153 (1927; issued 1930). There it is said that the bulbs were sent to Major Pam, Broxburne, England, as *H. tucumanum* Holmberg from Argentina. They flowered the following year and from those flowers the color plate was made. It is recounted that Holmberg described *H. tucumanum* from a bulb

in leaf and from the memory of a herbarium specimen of a white-flowered hippeastrum he had seen. Consequently, the description was rather meager. Because it differed from Major Pam's plant in the greater width of the leaves, and in somewhat smaller flowers, Doctor Stapf preferred to describe the latter as a new species, despite the fact that it probably came from the same region of Argentina. This seems rather unfortunate, because very probably only one species is concerned. Under the circumstances, however, it seems best to call our plant *H. candidum* because it seems to agree quite closely with Stapf's illustration and description.

Mr. Hoog states that Van Tubergen, Ltd., obtained their bulbs from the province of Salta, near Jujuy, Argentina, the same region where *H. tucumanum* grows. It is a country of scant rainfall, and of some frost, sometimes becoming as cold as 17.5° F.

Our bulbs were collected by the Allison V. Armour Expedition in 1933 near Port-au-Prince, Haiti, where they were said to be growing wild in dry, rocky soil. Immediately questions arise. Was our plant indigenous or an escape? If an escape, when was it introduced to Haiti? If indigenous, how odd that it was overlooked for so long! And how peculiar that it should occur in two such distant and different localities!

Only a brief description of the flowers is necessary. They are pure white on the expanded portions and light greenish yellow on the tube. In shape and size they are very near *H. ambiguum* (NATIONAL HORTICULTURAL MAGAZINE—Oct., 1938), but they seem a little more graceful in carriage, and a little more slender in the perianth tube. The perianth tube is 10 cm. long and only 4 to 5 mm. in diameter at its mouth. The expanded portion

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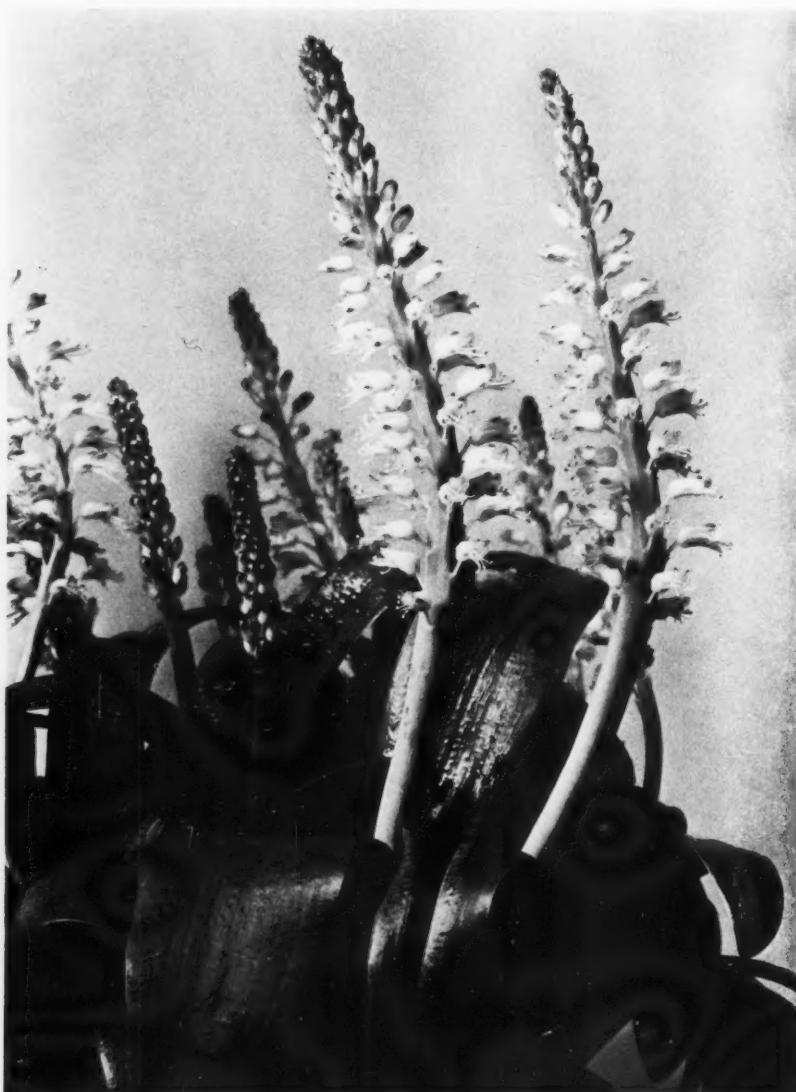
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Lilian A. Guernsey

Gladiolus vittatus

[See page 238]



Claude Hope

Lachenalia unicolor

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Claude Hope

Hippeastrum candidum

[See page 240]

of the flower widens gradually from the tube to a maximum width of about 10 cm., and it is about 10 cm. long. The segments are rather narrow and unusually regular for the genus. The upper outer one, 2.5 cm. across, is only slightly broader than its mates. The lower inner one, 1.8 cm. across, is only slightly narrower than its mates. The margins of all the segments are somewhat crisped, and all are recurved at the apex, the lowest one least of all. The declinate filaments carry yellow anthers which are about 2 cm. long before anthesis. The flowers emit a delightful fragrance that reminds one of *Amaryllis Belladonna*.

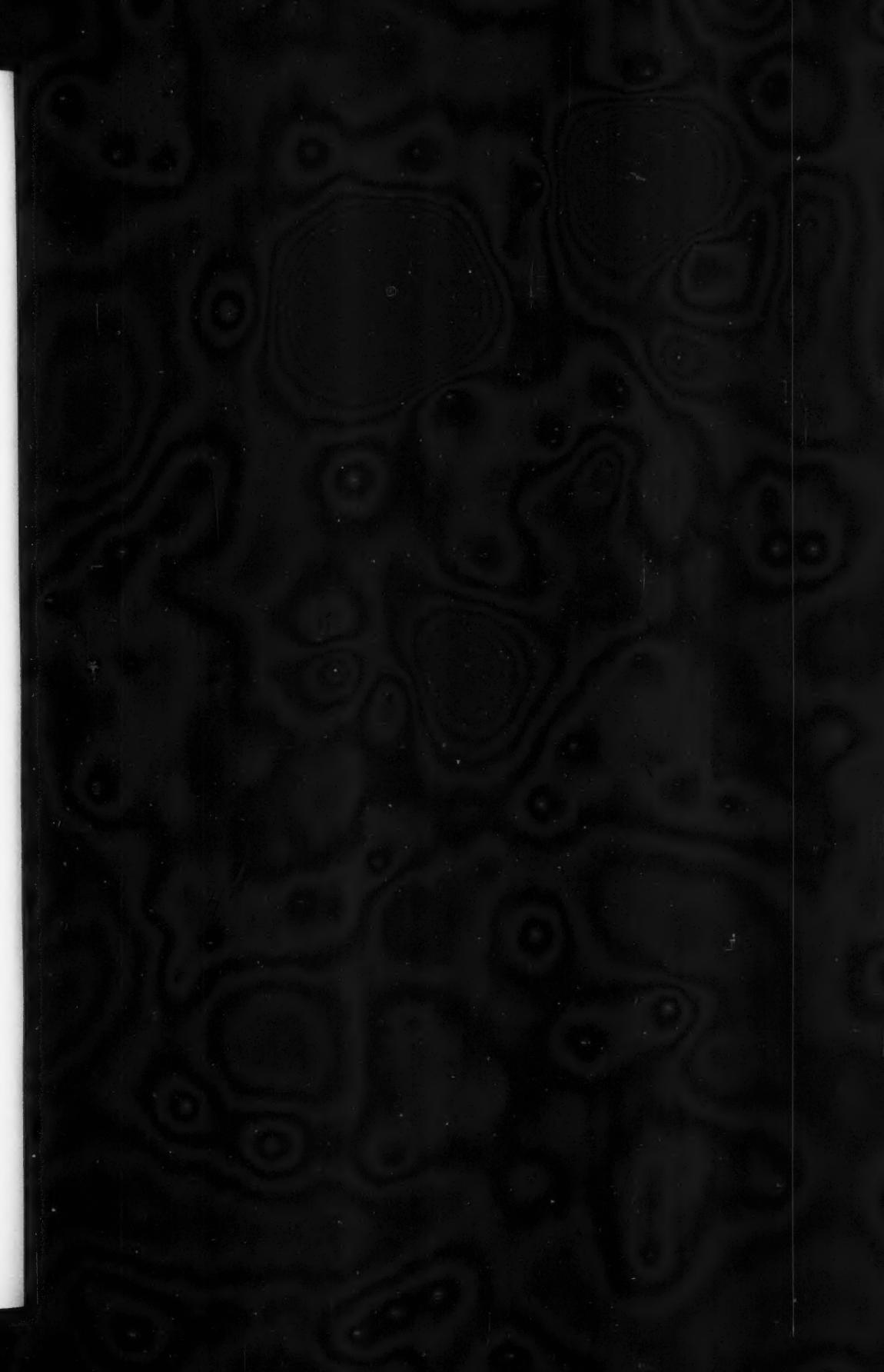
The peduncle of our plant is distinctly abnormal in length and in normal circumstances should be 50 to 70 cm. high. The number of flowers to the scape varies from 3 to 6 or 8. The pedicels are 4 to 6 cm. long and carry the flowers in a somewhat nodding

position. The spathe valves are lanceolate, erect and green in bud, but they soon wither. The leaves are from 2.5 cm. (in Stapf's plant) to 4.5 cm. across. They are particularly distinguished by the broad channel which extends from the base to the tip of the leaf.

Midsummer seems to be the normal flowering season. In culture, this plant may be somewhat different from most hippeastrums in tolerating or perhaps requiring a fairly cool winter and a hot dry summer. It has the reputation of scant flower production in England and Holland, and our experience bears it out.

It is said that it hybridizes freely with the common garden hippeastrums. As a consequence, we may expect fragrant hippeastrums, some pure white, in the near future. We may expect, furthermore, somewhat more graceful habits.

CLAUDE HOPE.
Washington, D. C.



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